WATER, LAND, AND RELATED RESOURCES

NORTH COASTAL AREA of CALIFORNIA and PORTIONS of SOUTHERN OREGON

MAIN REPORT

SEDIMENT YIELD and LAND TREATMENT

SEPTEMBER 1972

Prepared by the
UNITED STATES DEPARTMENT OF AGRICULTURE
RIVER BASIN PLANNING STAFF
SOIL CONSERVATION SERVICE FOREST SERVICE
ECONOMIC RESEARCH SERVICE
In cooperation with the
CALIFORNIA DEPARTMENT OF WATER RESOURCES

USDA-SCS-PORTLAND, OREGON 1972

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Berkeley, California

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California Department of Water Resources

under coordination of

USDA FIELD ADVISORY COMMITTEE

September 1972

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FEDERAL AGENCIES

- Department of the Army
  - Corps of Engineers
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- Department of Agriculture
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  - River Basin Staff, Oregon

COUNTY AGENCIES

- Mendocino County Engineer
- Mendocino County Farm and Home Advisor's Office (Agricultural Extension Service)
- Humboldt County Farm and Home Advisor's Office (Agricultural Extension Service)

STATE AGENCIES

- California
  - Department of Conservation
    - Division of Forestry
  - Department of Water Resources
  - Department of Fish and Game
  - Department of Public Works
    - Division of Highways

CITY AGENCIES

- Eureka City Engineer's Office

OTHERS

- Humboldt Bay Municipal Utility District
- Pacific Gas & Electric Company
- University of California
  - School of Forestry & Conservation
  - Hopland Field Station
- Numerous private industries and citizens

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SUMMARY

The objective of this study was to evaluate sediment yield, analyze land, water and management problems and to formulate methods of alleviating these problems utilizing U.S. Department of Agriculture programs. The study was done at the request of the California Department of Water Resources as a part of a series of studies designed to provide local benefits as well as facilitate the State Water Project.

Presented in this Main Report is an overall appraisal of the North Coastal River Basins by utilizing the technical data included in Appendix No. 1, Eel and Mad River Basins, June 1970; Appendix No. 2, Klamath, Trinity, and Smith River Basins, Russian River, Mendocino Coastal and Clear Lake Basins, June 1972; USDA Report on Water and Related Land Resources, Klamath Drainage Basin, Oregon 1970; and the North Coast Economics Appendix. Numerous other published reports and sources of information were utilized.

The area of the North Coastal River Basins is 25,415 square miles; 19,650 square miles in California, and 5,765 square miles in Oregon.

Streambank erosion, landslides and sheet and gully erosion are estimated to yield more than 26,000 acre-feet of sediment annually in the study area. Reduction of this erosion to an acceptable level will require protecting over 17,800 miles of stream channel, stabilizing 9,700 landslides covering 60 square miles, protecting over 4,000 square miles of grassland and over 15,200 square miles of timberland from sheet and gully erosion and reducing erosion problems on over 20,500 miles of roads.

Structural measures for stabilization of streambank erosion and landslides were investigated but found not to be economically feasible.

Floodwater damage is presently estimated to be in excess of 13.5 million dollars annually and is expected to climb to over 56 million dollars annually by 2020 without the needed protection measures. The December 1964 flood alone caused flood damage exceeding 202 million dollars. Both large and small flood control reservoirs are needed in the upper watershed areas while levees are needed in the alluvial deltas to protect cropland and communities from inundation.

Over 1,000 square miles have drainage problems. About 220 square miles of cropland need drain tile or open ditch systems to alleviate this problem. Good irrigation management is essential on 190 square miles and grading to eliminate low areas is needed on 70 square miles.

Water supplies were found to present only a minor problem that can usually be handled by local initiative. Water pollution, on the other hand, is a major problem and treatment systems are needed in several communities to control raw urban sewerage effluent and industrial wastes.

Fires in the area burn over 12,000 acres annually and although they are a major concern, fortunately they are usually not hazardous to human life. Man caused incendiary fires while not the most numerous, do burn the most acres and cause the most damage.

In any such area as the North Coastal River Basins which are largely in a sparsely populated natural state, a conscious effort must be maintained with all endeavors to guard and, if possible, improve the natural attractiveness of the area.

The following tabulation summarizes the program:

Type of Treatment	Installation	Operation, Maintenance and Replacement
Structural Measures	$ 53,625,000	$ 653,000
Land Treatment	105,768,000	5,554,000
Total	$159,393,000	$6,207,000

Under present USDA authorities, installation costs of the program would be borne as follows:

Type of Treatment	Federal	Private	Total
Federal Land			
Road Measures	$ 62,349,000		$ 62,349,000
Land Treatment	4,816,000		4,816,000
Subtotal	67,165,000		67,165,000
Non-Federal Land			
Structural Measures	28,646,000	$24,979,000	53,625,000
Land Treatment	21,976,000	16,627,000	38,603,000
Subtotal	50,622,000	41,606,000	92,228,000
All Land and Program Elements	$117,787,000	$41,606,000	$159,393,000

The tabulation above represents maximum involvement by the federal government under present legal authorities. The federal share could become less if more private money were invested or could become more if authorities were modified to permit that.

The impacts of the program include a reduction of slightly over 6,000 acre-feet in sediment yield, increases of over 690,000 animal unit months of grazing and 47 million cubic feet of timber, reduction of $455,000 per year in flood damges, net increases in wildlife habitat, water surface acres, and land fully irrigated, an estimated 1,000 man-year increase in employment, plus several other benefits. Most of these measures would enhance the environment rather than affect it adversely, however, more research is needed.

The recommended program primarily treats only that portion of the sediment caused by man's activities. Since nearly two-thirds of the sediment yield is naturally caused, such a program would be of limited

effectiveness with regard to reduction of sediment yield. In addition, any program solely to limit natural sediment production would be unduly expensive.

Guidelines for land and water management are presented in Appendices No. 1 and No. 2 to this report. These are designed to help rehabilitate present problem areas and to prevent future problems from developing.

To accomplish the program, the following are deemed necessary:

1. That steps be taken by the U.S. Department of Agriculture to put the recommended program of structural measures and land treatment into effect.

2. That the land management guidelines presented in Appendices No. 1 and No. 2 become the basis for USDA policy in managing federal lands, in providing technical help to private landowners, and for public information and education programs, to the extent that this is not now done.

3. That investigations be made to determine the advisability and feasibility of seeking changes in legislation to permit a larger federal share in cost-share programs with private landowners. The objective is to increase the application of land treatment measures on private land if it is clearly determined to be in the public interest.

4. That National Forest funding be increased to rehabilitate presently eroding roads, to provide for adequate road maintenance, and to allow for location, design, and construction of future roads to a standard that will prevent soil erosion.

5. That additional research be conducted to determine the effects of alternative land and water uses on water quality and quantity, and the effects on fish and wildlife.

NORTH COASTAL RIVER BASINS

(Area in Square Miles)

	California	Oregon	Total
Northern Basins[1]			
Klamath River			
Upper Klamath Lake	-	3,929	3,929
Butte Valley-Lost River	2,309	1,180	3,489
Salmon-Scott-Shasta	2,199	-	2,199
Middle Klamath	1,756	568	2,324
Mouth of Klamath	772	-	772
Sub-Total	7,036	5,677[2]	12,713
Trinity River			
Upper Trinity	1,013	-	1,013
Lower Trinity	1,024	-	1,024
South Fork Trinity	932	-	932
Sub-Total	2,969	-	2,969
Smith River	702	88	790
Total, Northern Basins	10,707	5,765	16,472
Eel and Mad River Basins			
Eel River			
Outlet Creek-Fillsbury	709	-	709
Middle Fork Eel	753	-	753
South Fork Eel	690	-	690
Van Duzen	429	-	429
Main Eel	1,324	-	1,324
Sub-Total	3,905	-	3,905
Mad River	929	-	929
Total, Eel and Mad River Basins	4,834	-	4,834
Southern Basins			
Russian River			
Northern Russian	1,010	-	1,010
Southern Russian	475	-	475
Sub-Total	1,485	-	1,485
Mendocino Coastal			
Mattole	499	-	499
Central Mendocino	666	-	666
Southern Mendocino	933	-	933
Sub-Total	2,098	-	2,098
Clear Lake	526[3]	-	526
Total, Southern Basins	4,109	-	4,109
Total, North Coastal Basins	19,650	5,765	25,415

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[1] The Oregon portion of the Klamath River Basin (5,677 square miles) was not included in the Northern Basins delineated in Appendix No. 2.

[2] Area included in USDA Report on Water and Related Land Resources, Klamath Drainage Basin, Oregon, 1970.

[3] Includes Clear Lake, 68 square miles.

USDA-SCS-PORTLAND, OREGON (1972)

NORTH COASTAL RIVER BASINS
CALIFORNIA AND OREGON
SEPTEMBER 1972

KLAMATH RIVER BASIN

SMITH RIVER BASIN

KLAMATH RIVER BASIN

MAD RIVER BASIN

EEL RIVER BASIN

MENDOCINO COASTAL BASINS

TRINITY RIVER BASIN

CLEAR LAKE BASIN

RUSSIAN RIVER BASIN

NORTHERN BASINS

SOUTHERN BASINS

OREGON

CALIFORNIA

KLAMATH

LAKE

JACKSON

DEL NORTE

SISKIYOU

MODOC

HUMBOLDT

TRINITY

MENDOCINO

LAKE

GLENN

SONOMA

KLAMATH FALLS

Tulelake

Crescent City

Yreka

Eureka

Willits

Ukiah

Santa Rosa

Fort Bragg

PACIFIC OCEAN

LOCATION MAP

JOSEPHINE CO.
JACKSON CO.
KLAMATH CO.
LAKE CO.
CURRY CO.
DEL NORTE CO.
MODOC CO.
SISKIYOU CO.
HUMBOLDT CO.
TRINITY CO.
North Coastal River Basins
MENDOCINO CO.
GLENN CO.
LAKE CO.
SONOMA CO.
CALIFORNIA

LEGEND

- Appendix No. 1 Study Area
- Appendix No. 2 Study Area
- Klamath Drainage Basin Report Study Area
- River Basin Boundary

SCALE 1:1,600,000

M7-N-21940

I N T R O D U C T I O N

NEED FOR THE STUDY

One of the major needs for the study was to provide decision makers with information in connection with the possibility of major water developments in the area for both local flood control and augmentation of water supplies for the State Water Project.

Economic development of these basins has taken place slowly and except in scattered locations, has not reached a high level compared to other parts of California and Oregon. Some of the deterrents to more rapid economic growth are:

1. The regular occurrence of serious sheet, gully, landslide, and stream channel erosion which inhibits development by limiting productivity and use of the resources and causes severe sedimentation damages in downstream reservoirs, on cropland, and in urban areas.

2. The recent leveling of production in the lumber industry which, coupled with increased productivity per worker, has reduced employment opportunity.

3. The limitations to agricultural development and production because of climatic restrictions of crop variety, lack of land suitable for irrigation, topographic restrictions of farm size, the limited supply of summer water in the Klamath Basin, and relative inaccessibility to markets.

4. The disastrous floods, which periodically cause huge damages to virtually all types of development in the North Coastal Area.

5. The seasonality of recreation and timber based industries.

OBJECTIVES AND NATURE OF THE STUDY

The survey had six major objectives:

1. To estimate the sediment yield by sources and causes under present conditions.

2. To estimate the future sediment yield under expected use and management.

3. To formulate a land treatment program that would reduce the sediment yield and to estimate the costs of remedial measures.

4. To evaluate the physical effects of the recommended program.

5. To evaluate the potential development that could be obtained through U.S. Department of Agriculture programs.

6. To coordinate USDA programs for watershed protection, flood prevention, agricultural water management, and related purposes with similar activities of state, local, and other federal agencies.

DESCRIPTION OF THE STUDY AREA

The study area covers the North Coastal Area of California and includes all streams and rivers that drain into the Pacific Ocean from the Russian River in the south to the Smith River near the Oregon border in the north. The Klamath and Smith River drainages in Oregon are included. The total area encompasses about 25,415 square miles, of which about 19,650 square miles are in California and 5,765 square miles are in Oregon.

The study area was divided into eight major river basins -- Russian, Mendocino Coastal, Clear Lake, Eel, Mad, Klamath, Trinity, and Smith -- as shown on the location map.

These basins are located either partially or entirely in the California counties of: Del Norte, Glenn, Humboldt, Lake, Mendocino, Modoc, Siskiyou, Sonoma, Trinity; and the Oregon counties of: Curry, Jackson, Josephine, Klamath, and Lake.

USDA AGENCIES PARTICIPATING IN THE STUDY

The U.S. Department of Agriculture agencies participating in this study are the Soil Conservation Service, Forest Service, and the Economic Research Service. The study is controlled and directed by the California Field Advisory Committee, which is comprised of a representative of each of the three participating agencies.

AUTHORITY FOR THE STUDY

The Secretary of Agriculture is authorized under Section 6 of the Public Law 566, 83d Congress, to make investigations and surveys of the watersheds of rivers and other waterways, in cooperation with other federal agencies and with states and local agencies, as a basis for the development of coordinated programs.

SPONSORING AND COOPERATING AGENCIES

On March 11, 1964, the California Department of Water Resources requested that the U.S. Department of Agriculture conduct a study of the Eel River Basin as a part of a series of studies designed to provide local benefits as well as facilitate the State Water Project. In the course of inter-agency deliberations, the Department of Water Resources extended its request to encompass the entire area of the North Coastal Basins.

Coordination of all joint planning efforts in California is provided by the California State-Federal Inter-Agency Group, which consists of the California Department of Water Resources, the Corps of Engineers, the Bureau of Reclamation, and the Soil Conservation Service. Other agencies are represented through their membership in the technical subgroups of the Inter-Agency Group. The Group will consider all agency study results in planning development of water and related land resources in the North Coastal Area.

HOW THE STUDY WAS MADE

Overall North Coastal Area investigations were made at a reconnaissance level, with added emphasis placed on sediment yield programs. Techniques and methods employed in the investigation are described in the five companion documents to this report:

1. Report on Water and Related Land Resources, Klamath Drainage Basin, Oregon, USDA, 1970.

2. North Coastal Agricultural Economics Appendix, USDA, 1972.

3. Water, Land, and Related Resources, Appendix No. 1, Eel and Mad River Basins, USDA, June 1970.

4. Water, Land, and Related Resources, Appendix No. 2, Klamath, Trinity, Smith, Mendocino Coastal, Clear Lake, and Russian Basins, USDA, June 1972.

5. Conservation Treatment of the Dry Creek Watershed, USDA, February 1966.

NATURAL RESOURCES

The natural resources of the North Coast, such as soil, minerals, vegetation, water, wildlife, and recreational opportunities are created by the basic assets of location, climate, physiography and geology unique to the area. In this chapter such basic endowments and other resources derived from them are inventoried in terms of quality, quantity, and location. Use and management of these natural resources is also described.

CLIMATE

Mean annual precipitation for the entire North Coastal Area is about 45 inches, although precipitation ranges from about nine inches in the eastern part of the Klamath River Basin to over 100 inches in the Smith River Basin. High precipitation also occurs in the South Fork of the Eel River Basin and in the Mattole River Basin. Generally, precipitation within the North Coast Area increases from south to north and from east to west. The following tabulation shows annual precipitation at selected locations.

Most of the precipitation is in the form of rainfall. Snow falls in moderate amounts above 2,000 feet, but only at altitudes above 4,000 feet does it remain on the ground for appreciable periods of time. Precipitation is distinctly seasonal with very little falling during the summer months, and about 77 percent of it occurring between November and March.

The area lying along the Pacific Coast has moderate temperatures, influenced greatly by the ocean. Heavy and recurrent fogs and northwest winds are common throughout much of the year. Inland the temperatures vary more widely. Summer temperatures are often quite hot and winter temperatures may hover within a small range near freezing for extended periods. Temperatures inland are heavily influenced by elevation and topography.

Annual Precipitation

Station	Annual Precipitation in Inches		
	Mean	Maximum	Minimum
Smith River Basin			
Crescent City	80	112	35
Monumental	101	124	90
Shasta River Basin			
Gazelle	11	18	5
Trinity River Basin			
Forest Glen	58	102	37
Hayfork	31	54	14
Hoopa	49	78	33
Weaverville	35	67	18
Eel River Basin			
Branscomb	77	133	46
Covelo	38	66	17
Eureka	37	74	21
Lake Pillsbury	40	63	27
Willits	51	97	19
Mattole River Basin			
Honeydew	107	174	79
Russian River Basin			
Healdsburg	38	73	17
Ukiah	35	60	16
Klamath River Basin			
Klamath Falls	13	20	8
Paisley	9	14	5
Butte Falls	33	50	26
Crater Lake	64	93	45

Source: California Department of Water Resources Bulletin 136 and Bulletin 83.

The following tabulation shows the average length of growing season (frost-free days) at selected locations throughout the basin. All are valley locations; mountain areas follow the same general pattern but have fewer frost-free days than adjacent valleys.

Location	Basin	Growing Season (Frost-Free Days)
Eureka	Lower Eel	335
Scotia	Eel	319
Fort Bragg	Mendocino Coastal	293
Crescent City	Smith	254
Santa Rosa	Russian	225
Ukiah	Russian	211
Alderpoint	Eel	202
Covelo	Middle Fork Eel	168
Yreka	Klamath	137
Klamath Falls, Oregon	Klamath	126
Weaverville	Trinity	116
Tulelake	Klamath	78
Alturas	1/	74
Chiloquin, Oregon	Klamath	31

1/ Alturas is outside the study area but the nearest point of record for for the extreme eastern portion of the study area.

PHYSIOGRAPHY

The physiography of the North Coastal Area is diverse, ranging from flat tablelands to rugged glaciated mountains. The area includes portions of four major geomorphic provinces -- the North Coast Ranges, Klamath Mountains, Cascade Mountains, and Modoc Plateau.

The North Coast Ranges Province includes the Russian River, Clear Lake, Mendocino Coastal, Mad River, and Eel River Basins. Most of the area lies at elevations of 2,000 to 4,000 feet, with a few peaks rising above 7,000 feet. The topography is generally steep and rugged although much of the Russian River watershed consists of subdued rolling hills. The only large flat areas are the Eel River Delta, stretches of the Russian River floodplain, and Willits, Potter, and Round Valleys. Clear Lake, the only large lake in the province, is the largest natural freshwater lake in California.

The Klamath Mountains Province is an area of rugged mountain topography. It includes the Smith and Trinity River Basins and the western third of the Klamath River Basin. Drainage in the province is irregular and, unlike that of the Coast Ranges, is not controlled by structural features. The mountains culminate in the Marble Mountains and Trinity Alps, where peaks rise to elevations between 8,000 and 9,000 feet. There are two large flat areas in the province -- Scott Valley, in the interior

SCS PHOTO 3-2214-2

Broad alluvial valleys traversed by meandering rivers and surrounded by brush and timber-covered mountains typify much of the North Coastal Area.

SCS PHOTO 3-4318-2

Varied topography and vegetation characterize the North Coastal Area (Eel River upstream from Lake Pillsbury).

Hi Ho Crater, Burnt Lava Flow Virgin Area - Modoc National Forest. This area is about 10 miles out of the study area but is typical of much of the Cascade Mountains and Modoc Plateau Provinces.

FOREST SERVICE PHOTO

FOREST SERVICE PHOTO

Mt. Shasta.

mountains, and the coastal plain north of Crescent City. Clair Engle Lake, an artificial reservoir on the Trinity River, is the only large lake.

The rest of the Klamath River Basin is included in the Cascade Mountains and Modoc Plateau Provinces. Both are part of a large volcanic field extending into Oregon and Washington. The Cascade Mountains are a line of volcanic peaks running north-south through a relatively flat volcanic tableland. Mt. Shasta (14,162 feet elevation), on the Klamath River watershed boundary, is second to Mount Ranier in Washington as the highest peak in the Cascade Range. Between Mt. Shasta and the Oregon border, peaks rise to elevations of 7,000 and 8,000 feet. The tableland to the east of the Cascades (Modoc Plateau) and a smaller area separating the Cascades from the Klamath Mountains (Shasta Valley) are areas of low relief, although some of the volcanic land is very rough. Drainage is irregular; some rainfall finds its way to the Klamath River and out to sea, but much of it drains to interior basins or into the groundwater table. Numerous lakes occur in the volcanic terrain; Meiss, Lower Klamath, Tule, and Clear Lakes are the largest.

SOILS

The soils in the North Coast are described by categories as follows: coastal mountain valleys; coastal mountains; interior valleys; Klamath-Cascade mountains, intermediate elevations; and Klamath-Cascade mountains, high elevations.

In the lower western ends of the coastal mountain valleys the soils are fine textured, wet, and saline in places from salt water encroachment. Flooding and deposition occur along some streams. Soils of the valley floors, low terraces, and fans are typically very deep, medium textured, well drained, and nearly level to gently sloping. On higher terraces and benches the soils generally have dense clay subsoils, with less rooting depth and fertility than the valley and low terrace soils. Sloping areas have erosion problems.

In the coastal mountains, soils are generally moderately fine to moderately coarse textured, moderately deep or deep, acid, and slopes are steep. About 60% of the land supports coniferous forest. The remainder is largely natural grassland and brushlands.

Soils of the interior valleys to the east of the coastal mountains are coarse to fine textured and are generally somewhat poorly drained and calcareous. Some are affected by alkali and have hardpans. On floodplains and low terraces the soils are generally well drained, very deep, and medium to moderately coarse textured, and where sloping are subject to erosion. On high terraces the soils are shallow, hummocky, well drained, medium textured, and have hardpans. They are generally dry and lower in fertility than those in the valley.

FOREST SERVICE PHOTO

Rumpled appearance of the terrain is indicative of the general geologic instability of the area. Above: Grassland area along Bear Ridge, Bear River Drainage-Mendocino Coastal Basins. Below: Along Lake Pillsbury Road-Upper Eel River Drainage.

FOREST SERVICE PHOTO

At intermediate elevations on the Klamath and Cascade mountains and Modoc plateau the soils are generally moderately deep to bedrock, medium textured, and acid in reaction. Slopes are rolling to very steep and erosion can be a problem where the soils are disturbed. Large acreages have forest vegetation but the shallower soils have low available water holding capacity and low fertility. These generally support woodland-grass or brush vegetation.

At high elevations on the Klamath and Cascade mountains, the soils are generally shallow or moderately deep to bedrock, medium to coarse textured, gravelly, and acid in reaction. Severe climate sharply limits their production potential. Their principal vegetal cover is brush or hardwood and coniferous forest. Above the timberline, there are broad expanses of rock land on ridge crests and peaks.

Detailed descriptions of soil associations and their use in the study are found in Appendices No. 1 and No. 2 and the Klamath Drainage Basin Report.

In the table "Land Capability" soils are interpreted and grouped into classes and subclasses according to the degree which slope, temperature, moisture, erosion, and fertility limit uses.

SCS PHOTO 3-6571

This photo illustrates several land-capability classes. As you go from Class I to Class VIII, choices in use become fewer and the risks become greater. Sonoma County, California.

LAND CAPABILITY

Land Capability Class and Subclass	Area in Square Miles By River Basin					Percent of Total Area
	Klamath, Oregon	Northern	Eel & Mad	Southern	Total	
I	-	-	-	25	25	0.1
IIc[1]	23	-	-	-	23	0.1
e	21	90	30	100	241	0.9
w	2	40	125	145	312	1.2
s	2	-	-	25	27	0.1
IIIe	86	255	20	65	426	1.7
w	82	150	25	80	337	1.3
s	91	140	-	-	231	0.9
IVc	25	-	-	-	25	0.1
e	130	130	570	315	1,145	4.5
w	213	100	35	-	348	1.4
s	18	370	-	15	403	1.6
Vw	136	-	-	-	136	0.5
VIe	2,388	1,780	2,300	1,395	7,863	31.0
s	132	1,350	20	55	1,557	6.1
w	24	-	-	-	24	0.1
VIIe	1,125	2,855	1,325	1,420	6,725	26.5
w	-	-	10	10	20	0.1
s	934	2,630	70	105	3,739	14.7
VIIIe	-	-	15	-	15	0.1
w	59	-	34	36	129	0.5
s	-	745	255	250	1,250	4.9
Subtotal	5,491	10,635	4,834	4,041	25,001	98.4

1/ Leading Factor That Limits The Use for Which Soil is Suitable*

		Square Miles
Climatic limitation	(c)	48
Poor soil drainage, wetness, high water table, and overflow	(w)	1,306
Erosion susceptability and past erosion damage	(e)	16,415
Shallow soils, stones, low moisture-holding capacity, low fertility and presence of salts and/or sodium	(s)	7,207
No limitations		25
Total Land Area		25,001

*More than one of these factors can occur as secondary limitations on the same piece of land.

SCS PHOTO 3-5018-14

Mass earth movement is common in the North Coastal Area, particularly in the western portion. Above: Bunker Hill Ranch near Ferndale, Lower Eel Drainage large cracks with intervening settlement due to mass earth movement. Below: Mud slide along Round Valley Road, in an intermittent drainage tributary to the Middle Fork of the Eel River.

FOREST SERVICE PHOTO

VEGETATION

Following is a summary of the present vegetation:

Present Vegetal Cover	Klamath River Oregon	Northern Basins[1]	Eel & Mad Basins	Southern Basins	Total	Percent of Total
Conifer	3,977	4,460	1,758	1,160	11,355	45
Woodland (Hardwood)	20	2,100	1,470	875	4,465	18
Grass	71	1,070	682	620	2,443	9
Woodland-Grass	22	520	40	165	747	3
Brush (Shrub)	805	1,990	596	680	4,071	16
Cropland	471	390	164	360	1,385	5
Other[2]	311	265	124	249	949	4
Total	5,677	10,795	4,834	4,109	25,415	100

[1] Includes 88 square miles in Oregon.

[2] Barren, rock, urban and industrial, and water areas are the main components of this type.

The vegetal cover on the North Coast has not been altered by man to the degree that it has been in many other parts of the two states. The major changes involve lands that have been converted from timber to grass in an effort to increase the grazing area; such conversions cover about 414 square miles. In addition, about 30 percent of the brush and about 15 percent of the grass is on lands with timber soils. This indicates that these lands were originally timbered but denuded by wildfire or logging. The trends of both types of conversion has slowed and may reverse themselves in the future. Public agencies are reforesting grass and brush fields and achieving greater control over wildfire. Private landowners are finding it to their advantage to keep their lands in forest or allow them to reforest. Also, legislative controls are having the effect of inhibiting conversion.

A relatively high percentage of the potential cropland is now being used, however, only a portion of that is irrigated. Substantial acreages of the conifer, woodland, grass, and brush land is on gentle slopes with soils suitable for agriculture. It is doubtful that much of the timber land will be converted to cropland but it is likely that some grass and brush lands will be. The extent of such changes will be determined by future economic conditions and the need for cultivated lands.

SCS PHOTO 3-5248-4

Mixed hardwood, primarily oaks, and scattered digger pine make up this woodland near Seigler Springs, Russian River Drainage.

FOREST SERVICE PHOTO

FOREST SERVICE PHOTO

Typical woodland-grass in Round Valley (left) and in the Navario River Drainage (right).

RIVER BASIN PLANNING STAFF PHOTO

Timberland converted to grassland near Pepperwood in the Larrabee Creek Drainage (tributary to Eel River).

RIVER BASIN PLANNING STAFF PHOTO

Converted lands on Fickle Ridge, east of Eureka.

FOREST SERVICE PHOTO

A stand of young trees, largely Douglas fir, occupying an area which was recently logged (8 miles south of Leggett, Eel Drainage).

FOREST SERVICE PHOTO

An area being allowed to revert to timber usage. The Douglas fir grows well where previous growth has been eliminated by burning. (Bear Ridge, Eel Drainage).

SCS PHOTO 3-5737-13

Grassland in good condition in the Navarro River Watershed.

SCS PHOTO 3-4840-15

Grassland heavily used showing signs of erosion. Laughlin and Yorkville soils - Eel River Watershed.

Urban and industrial developments have had a rather insignificant effect upon vegetal cover, compared to the rest of the state. The trend of urban-industrial encroachment is slowly increasing and will have more impact in the future. However, much of the housing development, particularly that in rural areas, does not change the vegetal cover because the subdivisions are designed to take advantage of natural conditions. Land use, especially timber harvest and grazing, is usually significantly modified.

The North Coast is 81 percent covered by forest and brush vegetation, three quarters of which is on commercial forest land. This region contains most of the Nation's redwood forests and extensive Douglas-fir forests as well as considerable areas of true firs, pine, and mixed stands of conifers.

The important climax forest vegetation types presently covered by conifer, woodland, and brush vegetation are:

Vegetation Type	Square Miles[1/]
Pine	3,200
Redwood	2,600
Douglas-fir	3,800
True firs	400
Mixed Conifers	4,607
Lodgepole Pine	600
Commercial Timber Types	15,207
Non-Commercial Timber Type, Non-Timber Type, and Productive Reserve	5,431
Total Forest & Brush Land	20,638

1/Adapted from Forest Survey.

LAND RESOURCE AREAS

There are portions of eight major land resource areas (LRA's)[1/] in the study area. Each of these geographic areas is characterized by a

1/Atlas of River Basins of the United States, U.S. Department of Agriculture, Soil Conservation Service, Washington, D.C., June 1970.

U. S. DEPARTMENT OF AGRICULTURE

SMITH RIVER BASIN

KLAMATH RIVER BASIN

MAD RIVER BASIN

EEL RIVER BASIN

MENDOCINO COASTAL BASINS

KLAMATH RIVER BASIN

TRINITY RIVER BASIN

CLEAR LAKE BASIN

RUSSIAN RIVER BASIN

OREGON

CALIFORNIA

KLAMATH

LAKE

JACKSON

SISKIYOU

MODOC

DEL NORTE

HUMBOLDT

TRINITY

MENDOCINO

GLENN

LAKE

SONOMA

Klamath Falls

Tuleloke

Crescent City

Eureka

Fort Bragg

Willits

Ukiah

Santa Rosa

PACIFIC OCEAN

LEGEND

- Olympic and Cascade Mountoins (Western Slope)
- Californio Coastal Redwood Belt
- Siskiyau - Trinity
- Coscode Mountoins (Eastern Slope)
- Central Californio Volleys
- Central Californio Coast Range
- Klomath and Shasta Volleys ond Bosins
- Sierra Nevoda Range

LAND RESOURCE AREAS

NORTH COASTAL RIVER BASINS

CALIFORNIA AND OREGON

SEPTEMBER 1972

SCALE 1:1,600,000

SOIL CONSERVATION SERVICE

M7-F-22605A-N

particular pattern of soil, climate, water resources, topography, and land use. The area in each of the LRA's is as follows:

Land Resource Area Number	Name	Area (Sq.Mi.)	Percent
3	Olympic and Cascade Mountains (Western Slope)	735	3
4	California Coastal Redwood Belt	4,215	17
5	Siskiyou-Trinity Area	8,135	32
6	Cascade Mountains (Eastern Slope)	2,552	10
14	Central California Coastal Valleys	664	3
15	Central California Coast Ranges	2,684	10
21	Klamath & Shasta Valleys and Basins	6,144	24
22	Sierra Nevada Range	286	1
	Total	25,415	100

WATER RESOURCES AND USE

The water resource is described in terms of total precipitation, surface water, and groundwater. The wild and scenic nature of the resource, the extent of development and use, and quality are also covered. The following table summarizes annual precipitation and runoff at representative stations.

SURFACE WATER

Monthly differences in runoff vary from basin to basin within the North Coast. Runoff in rivers of the Coast Ranges is rapid after winter rains due to steep topography, relatively impermeable soils and rocks and virtually no snowmelt; consequently, base flow is poorly sustained. Some rivers in the Klamath Mountains have relatively high base flows because of considerable snowmelt runoff. Although rainfall is low (10-20 inches per year), snow is common and slopes are relatively gentle compared to those of the Coast Ranges.

GROUND WATER

Ground water in the North Coastal Area occurs primarily in scattered alluvial valleys and coastal plains.

Total (gross) ground water storage capacity in the North Coastal Area exceeds 2,300,000 acre-feet, but only 60-70 percent of this water can

Summary of Mean Annual Precipitation and Runoff[1/]
(1931-1960)

Basin and Stream	Drainage Area (Sq.Miles)	Precipitation (Inches)	Natural Runoff 1,000's of Acre-Feet	Natural Runoff Inches
Klamath, Trinity, and Smith River Basins				
Smith River near Crescent City	609	111	2,681	82
Trinity River at Hoopa	2,865	55	4,143	27
Klamath River near Klamath	12,100	42	12,650	20
Eel-Mad River Basins				
Mad River near Arcata	485	64	1,036	40
Redwood Creek at Orick	278	80	712	48
South Fork Eel River near Miranda	537	70	1,244	43
Eel River at Scotia	3,113	59	5,468	33
Russian, Mendocino Coastal and Clear Lake Basins				
Dry Creek near Cloverdale	89	50	110	24
Russian River near Guerneville	1,340	45	1,358	19
Navarro River near Navarro	303	50	352	22

1/ Appendix V, Water Resources, California Region Comprehensive Framework Study, June 1971.

PRINCIPAL GROUND WATER BASINS IN NORTH COASTAL AREA[1/]

Ground Water Basin	Area (Sq.Mi.)	Depth of Water-Bearing Material	Total Storage Capy. (AC-FT)	Usable Storage Capy. (AC-FT)
Klamath, Trinity, and Smith River Basins				
Klamath Marsh	**	0 - 164	*	*
Wood River-Sevenmile Creek Area	**	0 - 164	*	*
Sprague River Basin	**	0 - 164	*	*
Tule Lake - Oklahoma	525	*	*	*
Butte Valley	475	*	*	*
Shasta Valley	340	*	*	*
Scott Valley	85	10 - 100	400,000	300,000
Smith River Plain	70	10 - 35	100,000	75,000
Hoopa Valley	8	*	*	*
Hayfork Valley	6	*	*	*
Eel - Mad River Basin				
Mad River Valley	57	15 - 25	25,000	25,000
Eureka Plain	53	15 - 25		
Eel River Valley	120	10 - 40	125,000	100,000
Round Valley	25	10 - 250	230,000	150,000
Laytonville Valley	7	10 - 100	25,000	12,000
Little Lake Valley	17	10 - 100	50,000	40,000
Russian River Basin				
Potter Valley	13	0 - 50	10,000	*
Ukiah Valley	65	0 - 50	35,000	*
Sanel Valley	10	10 - 50	20,000	*
Alexander Valley	35	10 - 50	50,000	*
Santa Rosa Valley	150	10 - 200	1,000,000	*
Healdsburg Area	30	10 - 50	70,000	*
Clear Lake Basin				
Upper Lake Valley	15	10 - 100	10,000	5,000
Scott Valley	4	10 - 100	5,000	4,500
Kelseyville Valley	31	10 - 100	105,000	60,000
High Valley	3	10 - 100	9,000	900
Burns Valley	2	10 - 60	4,000	1,400

1/ Appendix V, Water Resources, California Region Comprehensive Framework Study, June 1971.

* Data are not available for evaluating usable storage capacity in some ground water basins.

** Not determined.

be extracted to meet water needs. The table on page 23 lists the total and usable storage capacities, where known, of the principal ground water basins of the North Coastal Area. Location of these ground water basins is shown on the map following the table.

WATER QUALITY

Waters of the North Coastal rivers are generally of excellent chemical quality, however, sediment-caused turbidity remains a serious water quality problem. The most notable exception is the Klamath River Basin, where waste water discharges from the City of Klamath Falls and the surrounding lumber mills reduce water quality below Klamath Lake near the Oregon border. Downstream water quality increases with the inflow of high-quality tributaries except that, during the rainy season, septic tanks in the communities surrounding Humboldt Bay in the Eureka-Arcata area emit raw sewage that finds its way to the Bay.

Chemical quality of the surface water is also generally excellent for both drinking and irrigation. Some scattered instances of boron concentrations high enough to be detrimental to boron-sensitive crops occur in the upper reaches of the Eel River Basins and in the Shasta River. The Shasta River receives irrigation return water and boron concentrations greater than 0.5 ppm sometimes occur, downgrading the water quality to class 2 for irrigation purposes.

Ground water of the basin is of good quality and is suitable for most uses. Instances of salt water intrusion are known in ground water basins where concentrations of boron, manganese, and iron are high.

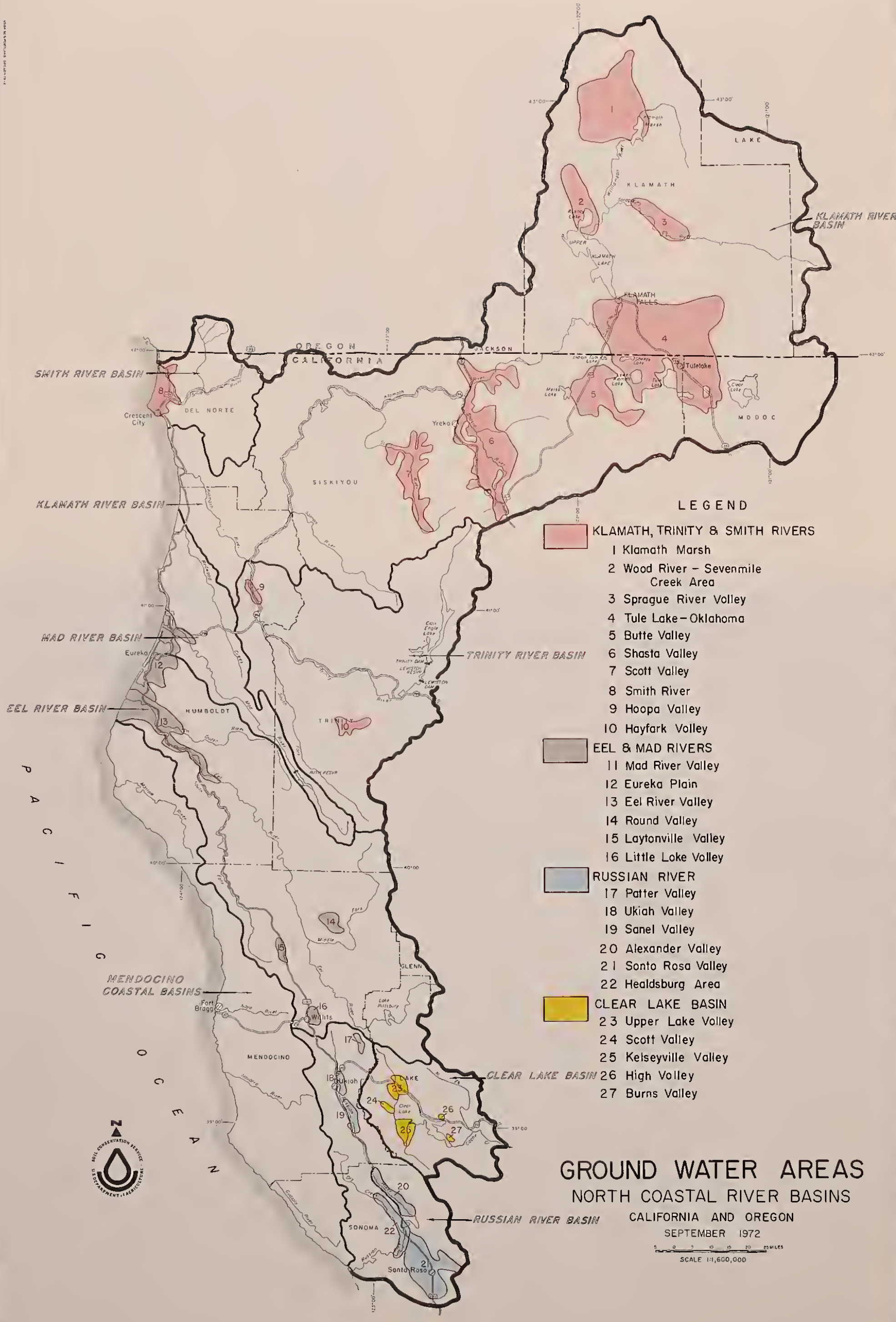
The heavy sediment loads of some rivers, especially the Eel and Mad Rivers, causes siltation of stream bottoms and smothers sensitive benthic fauna essential to fish production. Clogging of spawning gravels further reduces recreational fishery production so important to this area.

Individual basins in the area vary considerably in the quantity of sediment they yield. Representative suspended sediment yields for the North Coastal Area are shown on a table in the chapter "Water and Related Land Resource Problems."

WILD AND SCENIC RIVERS

In September 1970, the Federal Departments of Interior and Agriculture identified six rivers in California as being in accord with Section 5(d) of the Wild and Scenic Rivers Act. Under this section, the Secretary of the Interior and the Secretary of Agriculture are to identify rivers or segments thereof, in addition to those listed in the Act, which have potential for inclusion in the National Wild and Scenic Rivers System.

The North Coast rivers selected by that Federal Inter-Departmental Study Group for 5(d) designation are: the Klamath, segment from Iron Gate Dam to the mouth; the Russian, from Ukiah to its mouth at Jenner; the Smith, the entire main stem, the North Fork to Diamond Creek, the Middle Fork



LEGEND

KLAMATH, TRINITY & SMITH RIVERS
- 1 Klamath Marsh
- 2 Wood River – Sevenmile Creek Area
- 3 Sprague River Valley
- 4 Tule Lake–Oklahoma
- 5 Butte Valley
- 6 Shasta Valley
- 7 Scott Valley
- 8 Smith River
- 9 Hoopa Valley
- 10 Hayfark Valley

EEL & MAD RIVERS
- 11 Mad River Valley
- 12 Eureka Plain
- 13 Eel River Valley
- 14 Round Valley
- 15 Laytonville Valley
- 16 Little Loke Volley

RUSSIAN RIVER
- 17 Patter Valley
- 18 Ukiah Valley
- 19 Sanel Valley
- 20 Alexander Valley
- 21 Sonto Rosa Valley
- 22 Healdsburg Area

CLEAR LAKE BASIN
- 23 Upper Lake Volley
- 24 Scott Valley
- 25 Kelseyville Valley
- 26 High Volley
- 27 Burns Valley

GROUND WATER AREAS

NORTH COASTAL RIVER BASINS

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to Griffen Creek, and the entire South Fork. Other rivers have varying degrees of potential for this type of classification and some may be so designated after further study.

Selection of a river or river segment under 5(d) requires that the wild, scenic and recreation potential be evaluated prior to activation of any proposed federal project in the river area. Selection under 5(d) does not prohibit planning or construction programs or programs that change existing uses in the river area, but such planning and programs must proceed on the basis of complete understanding of how existing values would be modified.

USE

The three main consumptive uses of water in the basin are:

	Urban	Industrial	Irrigation	Total
	(Acre-Feet)			
Water Use	28,000	64,000	1,514,000	1,606,000

Out of a total of 1,606,000 acre-feet of water used per year in the basin, slightly more than 10 percent or 175,000 acre-feet per year is supplied from ground water.

Ground water overdraft has not been a basinwide problem, although localized areas may have experienced shortages.

LAND RESOURCES AND USE

The economy of the basins is tied directly to the productivity and utilization of the land resource. Timber, agriculture, and recreation are the most important segments of the economy and all use large areas of land surface. Mining, manufacturing, power production, transportation, and services are also important, but these activities use small amounts of land surface so they are all represented in this study as urban and industrial uses.

Urban and industrial uses satisfy some human needs through intensive development of the land. The other activities discussed in this chapter require less intensive uses of the land surface.

RESOURCE SUITABILITY

The many qualities of the land surface are summarized in this section into six broad groups according to the most likely and generally most appropriate uses for which the land is suited by today's standards of technology. These six general uses of land are:

1. Urban Development - land suitable for urban purposes.

2. Irrigation - land suitable for irrigation.

3. Crops - land suitable for crops, orchards, and vineyards.

4. Range or Pasture - land suitable for grazing.

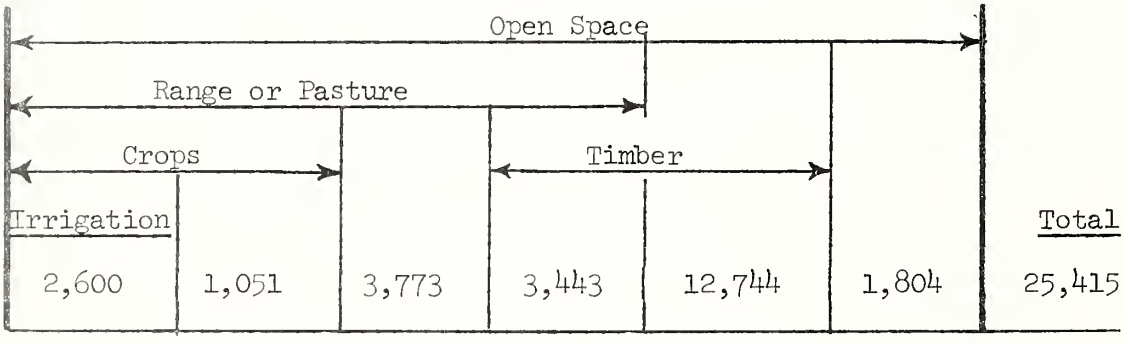
5. Timber - land suitable for the production of timber.

6. Open Space - land suitable for recreation, wildlife, watershed green belt, and water storage purposes.

In most cases, each piece of land is suitable for more than one of these uses. Multiple suitability has been considered in the following presentation.

Multiple Soil Suitability
(Square Miles)

Uses For Which Soil Is Suitable



Summary

Generalized Kind of Use for Which Soil is Suitable	Square Miles	% Of Study Area
Open Space	25,415	100
Irrigation	2,600	10
Crops	3,651	14
Range or Pasture	10,867	43
Timber	16,187	64

Variations in degree of suitability for irrigation are estimated to be as follows:[1]

		Square Miles
Class 1:	Land suitable for sustained high yields of most climatically adapted crops under sustained irrigation with minimum costs of development, and minimum cost of management associated with the land.	700
Class 2:	Lands moderately productive, or requiring moderate costs for development and management because of slight to moderate limitations in land characteristics.	1,200
Class 3:	Lands of restricted productivity for most crops or lands requiring relatively high costs for development and management because of moderate to severe limitations in land characteristics.	600
Class 4:	Lands adapted to few crops because of severe limitations in one or more land characteristics.	100
	Total	2,600

Viariations in degree of suitability for grazing are estimated to be as follows:[1]

		Square Miles
Group 1:	Land requiring one acre or less to produce one AUM.	770
Group 2:	Land requiring from one to ten acres to produce one AUM.	8,800
Group 3:	Land requiring from ten to twenty acres to produce one AUM.	380
Group 4:	Land requiring more than twenty acres to produce one AUM.	917
	Total	10,867

---

[1] Adapted from Appendix VI, Land Resources and Use, California Region Comprehensive Framework Study, June 1971.

Variations in degree of suitability for timber are estimated to be as follows:

Average Annual Growth By Site Class Under Natural Conditions for Fully Stocked Land[1]	Square Miles
Class I - 208 cu.ft.	5,342
Class II - 181 cu.ft.	1,457
Class III - 144 cu.ft.	4,856
Class IV - 98 cu.ft.	1,619
Class V - 58 cu.ft.	2,913
Total	16,187

[1] Adapted from soil data developed for this study.

LAND USE

The following table depicts generalized land use in the study area:

Generalized Land Use

Item	Square Miles
Range and Pasture	2,443
Cropland	1,385
Forest Land	20,638
Other Land	949
Total	25,415

Lands are used for multiple purposes but were categorized according to the objectives for which they appear to be managed. The following tabulation shows the approximate present land use pattern:

Present Primary Land Use	Area (Square Miles) Southern Basins	Eel & Mad Basins	Northern Basins	Klamath Oregon	Total	Percent Of Total Area
Urban & Built-up & Industrial	45	44	10	64	163	0.6
Water Surface	68	36	160	185	449	1.7
Cropland						
Irrigated	240	139	270	439	1,088[1/]	4.3
Non-Irrigated	120	25	120	32	297[2/]	1.2
Grazing	1,665	1,540	1,655	898	5,758	22.7
Grazing With Timber Production	0	0	440	2,319	2,759	10.9
Timber Production	1,220	2,280	4,630	1,043	9,173	36.1
Designated For:						
Recreation	20	135	200	155	510	2.0
Wilderness	0	75	725	103	903	3.6
Wildlife	160	140	250	66	616	2.4
Non-Designated:						
Open Space	571	420	2,335	373	3,699	14.5
Total	4,109	4,834	10,795	5,677	25,415	100.0

1/ Includes 132 square miles of farmstead, fallow, ditches, roads, etc.

2/ Includes 66 square miles of farmstead, fallow, roads, and other non-usable areas.

Urban and Industrial

The largest and most industrialized city is Santa Rosa. Other population concentrations are Ukiah, the Humboldt Bay Area, and Klamath Falls, Oregon. Scattered throughout the basins are several small towns, many of them relics of early logging, mining, and ranching activities. It is expected that population growth will result in more urban built-up development, but most will occur near the present population centers. Vacation home and resort development will probably occur in patches in the rural areas.

An increase in the use of land for powerlines and roads will follow population increases and more intensive use of the basins; however, expansion of railroad activity is not expected. Present urban and industrial use is mostly on land that was once suitable for irrigation cropland.

Irrigated and Non-irrigated Cropland

The major areas of irrigated cropland are widely scattered throughout the flood plains of the main rivers and along the Pacific Coast. They occur mainly around Klamath, Swan, Butte, Tule, and Clear Lakes, in the valleys of Williamson, Sycan, Sprague, Wood, Shasta, and Scott and Russian Rivers, along the coast, and in Round Valley. Non-irrigated croplands generally occur in fringes around the irrigated lands and are usually suitable for irrigation. Together they use about 5.5 percent of the land area in the North Coast.

There are four crop subareas in the North Coast (see North Coast Agricultural Economics Appendix). The coastal subarea, characterized by mild summers, is ideal for the livestock and poultry industries and the growing of Gravenstein apples, truck crops, and Easter lilies.

The southern interior subarea (eastern portion of Sonoma County, southeastern portion of Mendocino County, and the major portion of Lake County) also has mild weather conditions and contains most of the Class I and II land of the North Coast. Speciality crops grown in this subarea include: wine grapes, Bartlett pears, prunes, apples, and walnuts. These crops, with livestock and poultry, account for most of the value of agricultural production (see Economics Chapter).

The mountain subarea (western Siskiyou County, Trinity County, eastern Humboldt County, and the northeastern portion of Mendocino County), with very little land suitable for cultivation, has only limited use as a pasture, but can be used as range for grazing.

The mountain valley and plain subarea in Siskiyou and Modoc Counties and Klamath County, Oregon is characterized by low winter temperatures, relatively dry summers and winters, and fairly high elevations. Vegetables for processing, late summer onions and potatoes, food and feed grains, wheat, barley, hay, and range livestock provide the main sources of agricultural income.

Grazing

Grazing of cattle and sheep was one of the earliest land uses and is still economically important on a third of the land area. In the north this consists of fall, winter, early spring, and late summer pasturing on valley ranches and late spring and early summer grazing on mountain slopes. Often the latter is by permit on public lands, mainly national forest. About half of the land used for grazing is also used for timber production in the northern part of the study area.

In the south, much of the natural forage responds to winter rains and reaches its peak in late spring or early summer. After this period, stock on annual ranges must be moved to pastures, fed supplementally, or sold. Ranges near the coast are grazed yearlong because the cooler, more humid climate and the higher percentage of perennials tends to sustain forage growth. Other areas, such as the hills west of Santa Rosa, are also grazed yearlong because good management and a high percentage of perennials make such use possible.

About 11 percent of the land used for grazing is suitable for the development of irrigation and another 12 percent is suitable for non-irrigated crops. About 40 percent of the land used for grazing is suitable for and being used for timber production. About 414 square miles of timberland in the south have been converted to grass for grazing. Recently, the number of new conversions have decreased, and some previously converted areas are being allowed to revert to timber. The remaining 37 percent of the land used for grazing is not suitable for other forms of agriculture.

The acreage of land used for grazing is expected to decrease as increased population creates demand for other land uses, such as recreation and summer home sites.

Timber Production

The timber industry developed with the settlement of the North Coast, and quickly became the most important industry and now accounts for most of the income and employment. About 64 percent of the study area is suitable for growing timber of commercial quality and quantity but of this only about 58% is now adequately stocked with commercial timber species. About 6 percent of the adequately stocked commercial forest land is in productive reserves such as wildernesses or national parks and is not available for harvesting. The remaining 42 percent of the commercial forest land is non-stocked or is very poorly stocked with commercial species, and is covered mostly by non-commercial woodland or shrub vegetation.

About 17 percent of the commercial forest land is used for grazing simultaneously with timber production. Timber harvesting is modified on about 4% of the commercial forest land that is managed primarily for recreation and fish and wildlife.

About 3 percent of the commercial timberland acreage is logged each year, producing mainly saw logs, poles and the products of thinning operations.

The following tables show a breakdown of commercial and non-commercial forest land, ownership status, and productive capacity of the resources.

Forest Land in North Coast by County[1] and by Type of Forest
(Square Miles)

County	Forest Land			
	Commercial	Unproductive	Productive Reserves	Total
Del Norte	801	139	40	980
Humboldt	2,703	182	95	2,980
Lake	274	868	0	1,142
Mendocino	2,390	692	0	3,082
Modoc	166	264	20	450
Siskiyou	2,490	1,124	286	3,900
Sonoma	672	217	1	890
Trinity	2,332	483	315	3,130
Oregon Counties	3,379	482	223	4,084
Total	15,207	4,451	980	20,638

Commercial Forest Land in North Coast by County[1] and Ownership
(Square Miles)

County	National Forest	Other Public	Private	Total
Del Norte	550	0	251	801
Humboldt	464	200	2,039	2,703
Lake	155	6	113	274
Mendocino	170	212	2,008	2,390
Modoc	112	1	53	166
Siskiyou	1,668	34	788	2,490
Sonoma	0	9	663	672
Trinity	1,585	74	673	2,332
Oregon Counties	1,859	185	1,335	3,379
Total	6,563	721	7,923	15,207

[1] Includes only parts of counties within the North Coast hydrologic boundary. Adapted from Forest Survey and adjusted by River Basin Staff.

FOREST SERVICE PHOTO

Clear cut blocks in the Six Rivers National Forest. Douglas fir, the predominant species, is best harvested in this way to assure regeneration. In the national forests these blocks are generally harvested by some form of high lead system.

FOREST SERVICE PHOTO

A series of clear cut blocks form a pattern throughout the forest. As cut blocks regenerate, adjacent blocks are harvested. Blocks are designed to best fit the terrain to prevent excessive adverse physical and esthetic impacts upon the land.

Inventory and Annual Growth of Wood
on Commercial Forest Land
in North Coast Counties[1]
1965

	Growing Stock (Trees 5 inches or more in diameter in millions of cubic feet)	Sawtimber (Trees 11 inches or more in diameter in millions of board feet, International 1/4 inch rule)
Inventory		
Private	14,957	77,917
Public	15,479	78,155
Total	30,436	156,072
Annual Growth	485	1,855

[1] The term "North Coast Counties" is used to indicate that Forest Survey and Bureau of Census County data have been used without adjusting it to the North Coast hydrologic boundary. North Coast Counties include all of Del Norte, Humboldt, Mendocino, Siskiyou, and Trinity Counties of California and all of Klamath County, Oregon. Excluded from the North Coast counties are Glenn, Lake, Sonoma, and Modoc Counties in California, and Jackson and Lake Counties of Oregon, even though parts of these counties are within the North Coast hydrologic boundary.

Recreation

The North Coast possesses a wide variety of outdoor recreation environments. Rugged seacoasts, beaches, towering redwoods, brushy hills, wild rivers, high mountains, and flatlands are all present. The area is especially well-suited for big and small game hunting, fishing, natural areas, scenic areas, camping, and vacation cabins and homesites.

Natural areas are of wild and undisturbed character, with scientific as well as esthetic values. The major and most unique natural features of the study area are the redwood trees, samples of which have been preserved in Redwood National Park and several state parks, and the free-flowing streams which wind through mountainous woodland to their junction with the Pacific Ocean. Unusual features of geologic interest occur in the Cascade-Modoc Plateau region and some are preserved in Lava Beds National Monument and in Crater Lake National Park.

Public recreation facilities in the North Coastal Area are provided by the Redwood National Park, Lava Beds National Monument, Crater Lake National Park, Trinity National Recreation Area, King Range National Resource Area, parts or all of 11 national forests, the Upper and Lower Klamath, Tule Lake and Clear Lake National Wildlife Refuges, 35 state parks, historical parks, beaches, reserves, recreation areas, and wayside

campgrounds, 2 state forests, reservoirs administered by the Bureau of Reclamation, the Pacific Gas and Electric Company, the Corps of Engineers, and the Redwood Industry Recreation Areas. Many private facilities such as campgrounds, resorts, and golf courses augment the public facilities.

A 1965 inventory of the outdoor recreation by the Bureau of Outdoor Recreation[1/] (BOR), is used to describe the resource in the following tabulation.

ORC-81-11

At the Heart D. Guest Ranch, privately owned, mundane farm chores, such as feeding the chickens, provide fascinating entertainment and worthwhile education to city-bred youngsters.

1/ Appendix XII, Recreation, California Region Comprehensive Framework Study, June 1971.

Recreation Land Class Inventory

Definition of Resource	Land Ownership			
	Federal	State & Local[1]	Private[2]	Total
	(square miles)			
BOR Class I High Density Recreation Areas	0	8	0	8
BOR Class II General Outdoor Recreation Areas	140	20	40	200
BOR Class III Natural Environment Areas	10,700	200	8,200	19,100
BOR Class IV Outstanding Natural Areas	110	40	0	150
BOR Class V Primitive Areas	860	0	0	860
BOR Class VI Historic/Cultural Areas	3	0	0	3
Other[3]	160	217	4,717	5,094
Total	11,973	485	12.957	25,415[4]

1/ Includes city, county, special districts, etc.

2/ Includes rural areas and areas in communities under 5,000 population. Additional private lands may be available for recreation but have not been inventoried.

3/ Includes water surface, Indian Trust land, land not available for public trespass, and land that has not been inventoried.

4/ Source data was adjusted to include parts of the San Francisco Bay and Sacramento Basin Hydrologic Subregions that are included in the North Coastal Area of this report.

CALIFORNIA REDWOOD ASSN. PHOTO

Left: Redwood Industry Recreation area in the Van Duzen Drainage. Timberland owners open their lands to the public for recreation use.

Below: Campers at Lake Mendocino, Russian River Drainage.

CORPS OF ENGINEERS PHOTO

FOREST SERVICE PHOTO

Marble Mountain seen from Elk Valley, Marble Mountain Wilderness.

FOREST SERVICE PHOTO

Trail Gulch Divide, Salmon Trinity Alps Primitive Area.

About 510 square miles are devoted to specific recreation uses, and these are becoming more important, both in economic impact and effect upon other land uses. For example, about 88 percent of this land is suitable for timber production. General recreation use -- camping, fishing, hiking, and hunting, etc. -- is more prevalent on public lands, while specialized uses -- organization camps, summer homes, and hunting and fishing clubs, etc. -- are more common on private lands. Federal lands provide most of the recreation opportunities in the northern portion of the study area, while in the south private lands and state and municipal parks satisfy the bulk of the demand.

Wilderness

About 903 square miles of wilderness and wilderness-type areas are located in the study area. The following tabulation summarizes the present situation.

Wilderness Area	Jurisdiction	Approximate Area (Sq.Mi.)
Marble Mountains Wilderness[1/]	Klamath NF	335
Mountain Lakes Wilderness[1/]	Winema NF	36
Yolla Bolly-Middle Eel Wilderness[1/]	Mendocino & Shasta-Trinity NF	72[2/]
Salmon-Trinity Alps Primitive Area	Shasta-Trinity & Klamath NF	349[3/]
Gearhart Mountain Wilderness[1/]	Fremont NF	19
Sky Lakes Limited Area	Winema NF	46
Goodlow Mountain Natural Area	Fremont NF	2
Other	National Park Service	44[4/]
Total		903

1/ Wildernesses are classified under the National Wilderness Preservation Act of 1964.

2/ Area within the study basins only. Total wilderness is about 170 square miles.

3/ Primitive Areas are under study for inclusion in the Wilderness System. Acreage eventually classified may vary somewhat. Acreage does not include 97 square miles of private land inside the boundary of the primitive area.

4/ Includes wilderness type within the parks and monuments.

Wildlife

Because of its generally undeveloped nature, the North Coastal Area has an abundant fish and wildlife resource that is used commercially, and for sport and recreation.

Big game include mule deer, blacktail deer, Roosevelt elk, antelope, bighorn sheep, black bear, and cougar. Deer migrate into the higher elevations during the summer in search of preferred browse but are restricted because of snow to the lower elevations during the winter. Some deer remain within the study area and others move into and out of the study area during these migrations.

A small number of Roosevelt elk, which is fully protected, summer in the Klamath portion of the north coast and winter in the Rogue Valley outside the study area. There have been increased sightings of elk in the eastern portion of the basin.

A small population of antelope inhabits the Oregon portion of the Klamath Basin during the summer months but migrate to California during the winter. There is no open season on antelope in the basin, but their numbers continue to decline.

Black bear and cougar are scattered throughout the mountain areas in small numbers. There is a controlled season on bear on federal lands where they are considered game animals, whereas on other lands, they are classed as predators and are subject to hunting at all times. Cougar are classed as a game animal in Oregon and California and are protected by law.

Small game, an important segment of the basin wildlife resource, includes species of birds and furbearers. Bird species include mourning dove, ring-necked pheasant, valley quail, mountain quail, blue grouse, band-tailed pigeons, ruffed grouse, sage grouse, Hungarian partridge, chukar partridge, and wild turkey. Pheasant, valley quail, and dove are the more heavily hunted small game. Attempts to establish populations of chukar and turkey, and also to re-establish the Hungarian partridge, met with limited success. Turkey releases began in 1964, and even though numerous sightings have been reported, it is too early to assess the success of these releases.

The North Coastal River Basins in general and the Klamath Drainage Basin in particular are extremely important to both game and non-game waterfowl.

Approximately 80 percent of the waterfowl in the Pacific flyway pass through and spend some time resting and feeding in the Klamath Basin during spring and fall migrations. Peak fall populations occur just prior to the annual freeze, usually in November. During this period, waterfowl numbers often exceed 7 million which includes over 50 percent of the goose population in the Pacific flyway. Most species of North American waterfowl are present in the basin; however, pintail and mallard ducks comprise about 70 percent of the total. Other waterfowl species include widgeon, shoveler, redhead, canvasback, ring-necked,

Female Osprey near Hamburg, Klamath National Forest. Osprey, though neither rare nor endangered, are decreasing in numbers. The species depends upon fish for food and requires large snags for nesting sites.

FOREST SERVICE PHOTO

CORPS OF ENGINEERS PHOTO

Fish are an important resource in the North Coast, both for sport and commercial use. Lake Mendocino, Russian River.

and goldeneye ducks, and white-fronted, snow cackling, Canada, and Ross' geese. Most birds that utilize the area are transient. Others, mostly mallards, but also the less common species, such as redhead, cinnamon teal, ruddy duck, gadwall, and shoveler, nest in the basin.

Muskrat, beaver, mink, and other furbearing animals are found in abundance in the marshes along rivers and around lakes and their tributaries. Controlled trapping of these animals is permitted.

The fisheries resource is composed of anadromous and resident species. Anadromous fish include king and silver salmon, steelhead trout, striped bass, American shad and white and green sturgeon. Anadromous fish occur on all the major streams in the study area except in the Upper Klamath Basin where Irongate Dam is a barrier. Silver salmon are found only in North Coast streams. At least 80 percent of California's steelhead catch and spawning escapement is also confined to North Coast streams. Anadromous fish resources are suitable for both commercial and sport purposes.

Resident inland fisheries are found in cold water streams, warm water streams, canals, tidal canals, natural lakes and ponds, and both warm water and cold water reservoirs. Rainbow trout, the most common fish in most streams, lakes, and reservoirs, is the most important resident game fish in north coastal waters. Other popular trout and landlocked salmon are brook trout, brown trout, Dolly Varden, kokanee, and coho salmon.

Warm water game fish, including brown bullhead, black crappie, white crappie, largemouth bass, yellow perch, bluegill, and pumpkinseed, are of significant recreational value. The Lost River sucker or mullet fishery is unique to the Upper Klamath Drainage Basin where spearing, gaffing, and snagging are legal methods for taking them.

Non-game, or rough fish, are well established throughout the area. Suckers, dace cottids, chubs, and lamprey are all found in coinciding or overlapping segments of basins.

About 616 square miles of land scattered through the study area is dedicated to fish and wildlife uses. Some of this land is limited exclusively to fish and wildlife purposes and some of this land is used coincidentally for agriculture, grazing, timber production, and recreation. Included in this land are five national wildlife refuges, five national wildlife management areas, eight state refuges, one national and state cooperative land and wildlife management area, one national conservation area, and one preserve held by a nature conservancy.

Not included as designated wildlife areas are the national forests and public domain lands, where the Forest Service and Bureau of Land Management, respectively, manage wildlife habitat as a part of their multiple use programs. For some areas, such as deer winter ranges, special management programs are designed for the improvement of the habitat. Many landowners restrict hunting and fishing by limiting access or by allowing use only by permit; some manage game habitat to enhance wildlife;

while others construct fish ponds to make their lands attractive to hunters and fishermen. A few receive substantial income from this source.

The amount of land set aside for wildlife is not expected to increase greatly in the future.

Open Space

No land in the study area has been set aside specifically to satisfy open space needs. However, about 15% of the area is presently being so used because it is yet undeveloped. In addition, the vast areas of national parks and monuments, national forests, public domain and other public lands, covering almost half of the area, assure that future open space needs will be adequately satisfied. Except for national forest wildernesses and the national parks and monuments, these lands are used for other purposes but the nature of those uses are such that they generally do not interfere with open space qualities. Much of the private land use, particularly agriculture, grazing and timber operations, tend to preserve open space. As populations increase, particularly in the southern part of the study area, there may be a need to set aside open space areas near the larger cities. Otherwise, no problem is foreseen.

The foregoing sections on present land use and multiple land use suitability are summarized in cross-tabular form on the following page.

SCS PHOTO 3-5100-3

Open space is a valuable component of lands used for recreation. Heart D. Guest Ranch, Fort Jones, California.

Present Land Use Generalized by Multiple Land-Use-Suitability
(Square Miles)

Present Land Use	Multiple Land-Use-Suitability: Cultural Development or Open Space; Grazing; Crops: Irrig.	Crops	Grazing	Timber	Timber	Cultural Development or Open Space	Total
Urban & Industrial	163						163
Water Storage			449				449
Cropland							
Irrigated	1,088						1,088
Non-Irrigated	297						297
Grazing	932	1,051	3,149	626			5,758
Grazing with timber				2,759			2,759
Timber					9,173		9,173
Designated For:							
Recreation					431	79	510
Wilderness				40	300	563	903
Fish & Wildlife	120		175	18	191	112	616
Non-Designated:							
Open Space					2,649	1,050	3,699
Total	2,600	1,051	3,773	3,443	12,744	1,804	25,415

LAND OWNERSHIP

The following is a summary of present land ownership in the study area:

	Area (Square Miles)				
	Oregon	California			
	Klamath Basin	Northern Basins	Eel & Mad Basins	Southern Basins	Total
Public Land (By Administrative Responsibility)					
Forest Service	2,215[3]	7,201	1,069	46	10,531
Bureau of Land Management	427[3]	308	147	168	1,050
Bureau of Sport Fisheries and Wildlife	47	2	-	8	57
National Park Service	152	114	49	0	315
Bureau of Reclamation	8	30	-	1	39
Department of Defense	11	1	-	3	15
Subtotal (Federal Lands)	2,860	7,656	1,265	226	12,007
State Land	191	80	45	94	410
Other Public Land[1]	[4]	56	19	0	75
Subtotal (Public Land)	3,051	7,792	1,329	320	12,492
Private Land					
Individual & Corporate Land	2,405	2,856	3,474	3,789	12,524
Indian Trust Land[2]	221	147	31	0	399
Subtotal (Private Land)	2,626	3,003	3,505	3,789	12,923
Total	5,677	10,795[5]	4,834	4,109	25,415

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[1] County, city, and special district land.

[2] Includes private Indian holdings and tribal lands within the reservation boundaries.

[3] Includes railroad grant lands that have reverted back to federal government.

[4] Included with private land ownership.

[5] Includes 88 square miles in Oregon.

About 50 percent of the land in the study area is publicly owned. Virtually, all of this public land is federally owned, with only a scattering of state and municipal ownership.

About 85 percent of the public lands and 41 percent of all ownership is in national forests. This land is generally in large solid blocks, covering about 67% of the Northern Basins, 22% of the Eel-Mad Basin, and slightly more than 1% of the Southern Basins. About 8% of the public land and 4% of all land in the study area is public domain administered by the Bureau of Land Management and is generally in consolidated blocks that occur in the Klamath, Trinity, Clear Lake, and Mendocino Coastal Basins.

About 1% of the public land is administered by the National Park Service, and is comprised of Lava Beds National Monument, Crater Lake, and Redwoods National Parks. The bulk of the Bureau of Reclamation holdings are in the Upper Klamath Basin in the vicinity of Tulelake, Lower Klamath, and Clear Lake reservoirs. Part of each of these reservoir areas is a national wildlife reserve. The Bureau of Reclamation has other small scattered holdings, mainly in connection with water development projects.

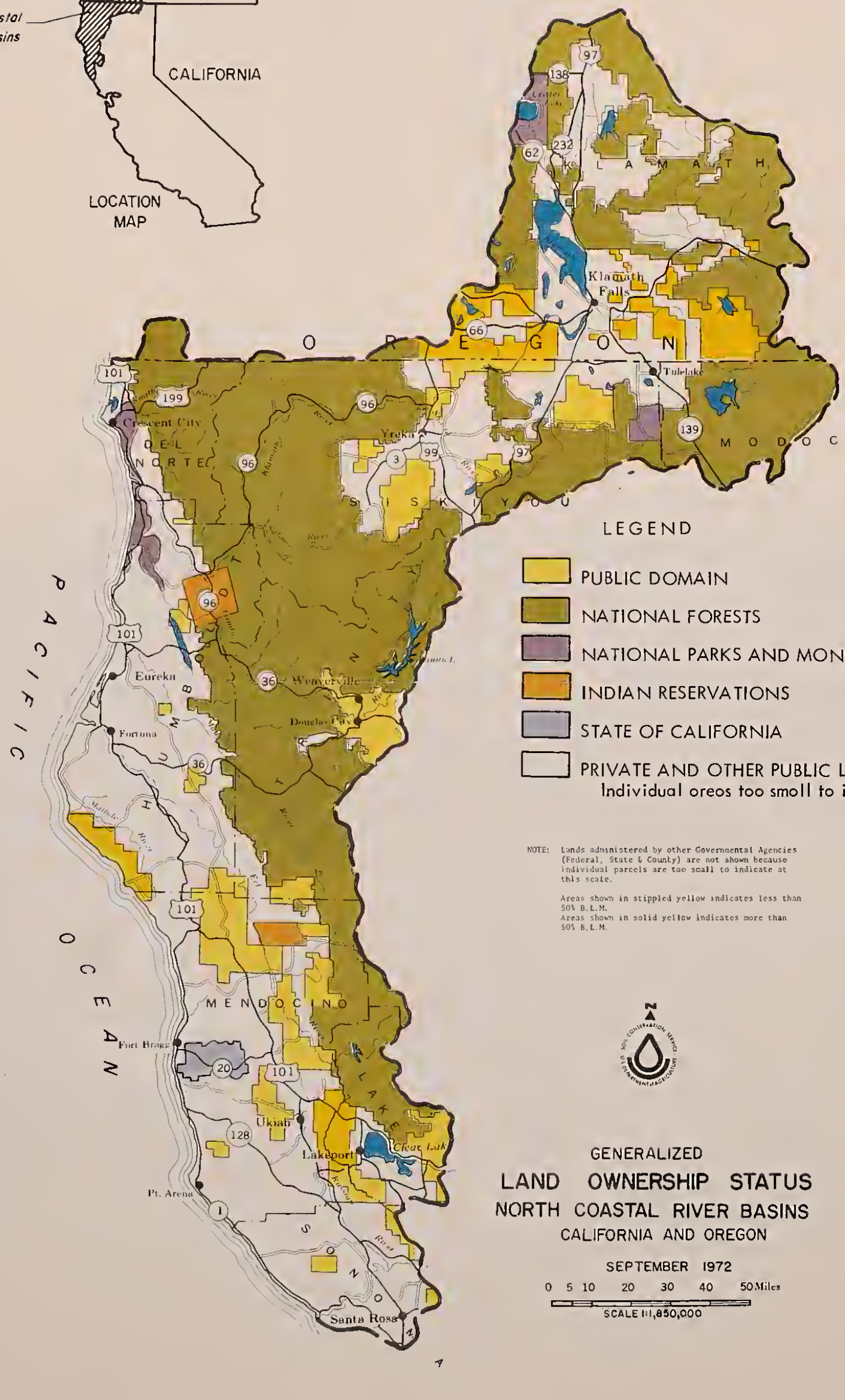
Department of Defense administers small, scattered holdings connected with flood control projects. The Bureau of Sport Fisheries and Wildlife administers similar parcels for fish and wildlife purposes.

State and local ownerships make up the balance of the publicly owned lands. Most of the state lands are contained in state parks scattered through the area and in the Jackson State Forest near Fort Bragg. The state parks generally are set aside to preserve unique stands of redwood trees. Local holdings are mainly muncipal parks and special district lands.

The rest of the study area is privately owned.

USDA-SCS-PORTLAND, OREGON 1972

U. S. DEPARTMENT OF AGRICULTURE



LEGEND

- PUBLIC DOMAIN
- NATIONAL FORESTS
- NATIONAL PARKS AND MONUMENTS
- INDIAN RESERVATIONS
- STATE OF CALIFORNIA
- PRIVATE AND OTHER PUBLIC LANDS - Individual areas too small to indicate

NOTE: Lands administered by other Governmental Agencies (Federal, State & County) are not shown because individual parcels are too small to indicate at this scale.

Areas shown in stippled yellow indicates less than 50% B.L.M.
Areas shown in solid yellow indicates more than 50% B.L.M.

SOIL CONSERVATION SERVICE

GENERALIZED LAND OWNERSHIP STATUS NORTH COASTAL RIVER BASINS CALIFORNIA AND OREGON

SEPTEMBER 1972

0 5 10 20 30 40 50 Miles

SCALE 1:1,850,000

M7-N-22627

Approximate Distribution of Private Land

Type of Holding	Square Miles	Average Size In Acres	Number Of Holdings
Urban Land	163	N/A	N/A
Indian Trust Land	399	N/A	N/A
Rural Land[1/]			
Up to 180 Acres	961	60	11,000
180 to 5,000 Acres	6,800	1,000	3,700
5,000 and more Acres	4,600	>30,000	<100
Total	12,923		

1/ Based upon (1) U.S. Census of Agriculture, California 1964, Department of Commerce;
(2) Commercial Forest Resources and Forest Products Industries of California, by Zivnuska, et.al., University of California, 1965.

Large acreages of forest owned by big timber corporations are common, but considerable timberland is also contained in small ownerships. Farm and ranch lands account for most of the balance of the private lands. A relatively recent trend is the sale of small parcels, either in subdivisions or in individual plots, for home construction; both vacation and permanent homes are involved.

Included in the private holdings are urban areas and Indian trust lands, the latter are located mainly in the vicinity of Crater Lake, Klamath Basin, Oregon, in the Hoopa Reservation near the mouth of the Trinity River, and Round Valley Reservation near Covelo on the Eel River.

E C O N O M I C S

The economy of the North Coastal Area is characterized by a close dependence on local natural resources. These resources consist primarily of timber, fish and wildlife, irrigable land, ground and surface water, minerals, and recreation opportunities. Principal industries of the area are lumber, agriculture, fisheries, and recreation.

For the more than 100 years during which there have been settlements in the area, the location of population centers and pattern of population growth have run parallel to development of the area's natural resources. In most cases, the growth of individual towns has been associated with development of local resources. On the other hand, economic growth has been inhibited by inaccessibility due to mountainous terrain and lack of harbors and limitations on agriculture due to lack of irrigable land and a lack of markets.

The initial influx of people to the area was prompted by the discovery of gold in Trinity and Siskiyou Counties in the 1850's. When the gold mining decreased, efforts were turned toward lumbering and limited agriculture. These activities developed slowly for many years because of transportation problems and the scarcity of good land for farming.

ECONOMIC VARIABLES

POPULATION

The area is sparsely populated--about 15 people per square mile in 1967, compared to a California average of 125. Most of the population is concentrated in Santa Rosa (48,450), Ukiah (10,400), the Humboldt Bay area (Eureka 28,137, Arcata 6,000), and in Klamath Falls, Oregon (16,949).

The North Coast currently has about 1.4 percent of the Region's[1/] population and the share has steadily declined in the last 40 years (see table on page 50). The rate of population growth has lagged considerably behind the Region. In the last 10 years, the southern part of the area (Sonoma and Lake Counties) has exceeded the Regional growth rate, but the rest has lagged considerably behind. Del Norte, Humboldt, Mendocino, Siskiyou, Modoc, and Trinity Counties have actually experienced a decrease in population. With the exception of Modoc County, this is a drastic reversal of the large population increase during the 1950's (see table on page 51).

1/ Unless otherwise noted, data for the North Coast Area includes data for the Oregon portion. Likewise, the California Region, or simply the Region, as used here, includes California and the part of Oregon used in the California Region Framework Study.

Historical Population of the North Coast and California Region

Year[1]	North Coast[2]	California Region[2]	Percent of Region	Percent Increase North Coast	Percent Increase Region
1930	138,391	5,710,000	2.43	-	-
1940	152,713	6,948,000	2.21	10.34	21.66
1950	204,693	10,578,000	1.98	34.03	53.25
1960	280,666	15,765,000	1.78	37.11	48.47
1970	287,182	19,838,000	1.41	2.32	25.84

[1] April 1.

[2] Includes the Oregon part of the Klamath Basin.

NOTE: The figures are derived by adjusting the North Coast data from the California Region Appendix IV, Economic Base and Projections to include the Russian River and Clear Lake Basins.

EMPLOYMENT

Total employment was 102,940 in 1965. The employment to population ratio was .370. The largest employer in the area, with the exception of the service industries, is the lumber and wood products industry with over 23,000 employees. This is half of California's employment in the industry. Other major employers are agriculture, forestry, and fisheries 7,056; food and kindred products 1,654; and paper and allied products 770.

The unemployment rate is almost twice the rate for California mainly due to the seasonal nature of the lumber and recreation industries. During the winter months, unemployment in the Eureka area climbs to approximately 15% of the work force.[1]

The table on page 52 presents a summary of pertinent data regarding the civilian labor force.

INCOME

Income levels in the North Coast, $2,662 per capita, are below the $3,095 per capita income of the Region. Earnings per worker, $5,923, are also below the Regional average of $6,789 (California Region Framework Study). Only Sonoma County (.78 percent) accounts for more than one-half percent

[1] California Department of Finance, Technical Paper Series 6.3-1.

Population of California North Coast Counties and State Total, Censuses of 1940-70

County	April 1, 1940	April 1, 1950	April 1, 1960	Change 1950-60 Number	Change 1950-60 Percent	April 1, 1970	Change 1960-1970 Number	Change 1960-1970 Percent
Del Norte	4,745 (.07)	8,078 (.08)	17,771 (.11)	9,693	120.0	14,432 (.07)	-3,339	-18.8
Humboldt	45,812 (.66)	69,975 (.66)	104,892 (.67)	35,651	51.5	98,211 (.50)	-6,681	-6.4
Lake	8,069 (.12)	11,481 (.11)	13,786 (.09)	2,305	20.1	18,816 (.10)	5,030	36.5
Mendocino	27,864 (.40)	40,854 (.39)	51,059 (.32)	10,205	25.0	50,610 (.26)	-449	-.9
Modoc	8,713 (.13)	9.678 (.09)	8,308 (.05)	-1,370	-14.2	7,265 (.04)	-1,043	-12.6
Siskiyou	28,598 (.41)	30,733 (.29)	32,885 (.21)	2,152	7.0	32,701 (.17)	-184	-.6
Sonoma	69,052 (1.00)	103,405 (.98)	147,375 (.94)	43,970	42.0	199,360 (1.01)	51,985	35.3
Trinity	3,970 (.06)	5,087 (.05)	9,706 (.06)	4,619	90.8	7,235 (.04)	-2,471	-25.5
California	6,907,387	10,586,223	15,717,204	5,130,981	48.5	19,779,156	4,061,952	25.8

NOTE: Figures in parenthesis are percent of State total.

Source: California Statistical Abstract, 1970, Tables B-5, B-6.

Civilian Labor Force, Employment & Unemployment[1] by Labor Market Area & Selected Counties, 1960, 1968-1969

Labor market area or county	1960	1968	January - June 1968	January - June 1969
Del Norte[2]				
Civilian labor force	6,900	6,100	6,100	6,100
Employment	6,200	5,600	5,500	5,500
Unemployment	700	500	600	600
Unemployment rate (percent)	10.1	8.2	9.8	9.8
Humboldt[2]				
Civilian labor force	40,400	39,800	39,600	40,300
Employment	37,000	37,000	36,400	37,200
Unemployment	3,400	2,800	3,200	3,100
Unemployment rate (percent)	8.4	7.0	8.1	7.7
Lake[2]				
Civilian labor force	5,400	6,500	6,200	6,200
Employment	4,900	6,000	5,600	5,600
Unemployment	400	500	600	600
Unemployment rate (percent)	7.4	7.7	9.7	9.7
Mendocino[2]				
Civilian labor force	17,900	18,900	18,600	18,800
Employment	16,300	17,500	17,000	17,300
Unemployment	1,700	1,400	1,000	1,500
Unemployment rate (percent)	9.5	7.4	8.6	8.0
Sonoma[2]				
Civilian labor force	50,300	65,200	64,200	66,200
Employment	46,400	60,700	58,800	61,100
Unemployment	3,900	4,500	5,400	5,100
Unemployment rate (percent)	7.8	6.9	8.4	7.7
California				
Unemployment rate[3] (percent)	5.8	4.5	5.2	4.6
United States				
Unemployment rate[3] (percent)	5.5	3.6	4.0	4.1

1/ Employment and unemployment may not add to labor force because of trade disputes and roundings. Persons involved in trade disputes are included in the labor force, but are excluded from employment and unemployment.

2/ January-June 1969 data based on three month's average of Feb., April, and June. Information not currently available for other months of the period. For comparability, Jan.-June 1968 averages are computed on the same basis.

3/ Unadjusted rate.

Source: California Statistical Abstract, 1969, Tables C-9, C-10.

Total Personal Income, By County, 1955-1969,
Income Per Capita, 1968

County	Total personal income				Income per capita
	1955	1960	1965	1969	1968
	million dollars				dollars
Del Norte	31.9	37.3	45.9	46.5	2,793
Humboldt	198.8	232.2	288.8	388.8	3,150
Lake	18.7	25.4	38.4	54.4	2,763
Mendocino	95.6	103.1	135.1	166.9	2,919
Modoc	18.0	19.7	21.7	24.7	3,311
Siskiyou	65.0	70.9	97.1	116.8	2,217
Sonoma	225.1	306.7	474.4	664.0	3,329
Trinity	11.4	21.3	19.4	21.3	2,726
California	30,379.0	42,980.0	60,234.0	83,407.7	3,916

Source: 1971 California County Fact Book, pp. 48-50.

of the total Region's personal income (see table on p. 53). In general, the share of the Regional personal income has been declining in the last 10 years.

Fifteen percent of the 1967 personal income of the North Coast came from transfer payments compared to 9 percent for the Region. (California Statistical Abstract 1968, Table D-8). All counties with the exception of Klamath County, Oregon, are eligible for full assistance under the Economic Development Administration of the Department of Commerce.

EDUCATION

In general, the population of the North Coast is less educated and less "skilled" than the rest of the Region. The median school years completed by persons 25 years old and older is about one year less than that for the Region (12.1 years) but about one-half year more than the United States average (see table on p. 55). The percent with at least four years of high school is slightly higher than the U.S. average (41.1) but considerably below the Region's average (51.5). Those with at least four years of college are considerably below the Regional average, 10.7 percent as compared to 6.2 percent for the North Coast. Those people classified as professionals, technical and kindred workers in the North Coast are only about 11 percent of the employed people as compared to 13.7 percent for the Region.

TRANSPORTATION

Transportation development in the North Coast Basins has been hampered by its geography, but improved construction equipment and technology is breaking this barrier. Highways that serve the area are U.S. Interstate 5, U.S. 97, 99, and 199, several California routes, the principal of which are 1, 20, 36, 96, 128, 136, and 299, and Oregon routes 39, 58, 62, 66, 138, and 140.

The principal railroad is the Northwestern Pacific running from San Francisco to Arcata. The Southern Pacific and Great Northern Railroads also serve the area.

Commercial air service is available at Santa Rosa, Ukiah, the Eureka area, and Klamath Falls.

Humboldt Bay at Eureka is a deep water port serving coastal and foreign shipping.

PROJECTIONS OF MAJOR ECONOMIC VARIABLES

Three levels of projections were considered, OBERS '68 and OBE '69, OBE '71, and Series D. OBERS '68 was developed at the Washington level by the Office of Business Economics and Economic Research Service for the Water Resources Council and assumes a California Region population at 54.9 million by year 2020. OBE '71 was developed by the Water

Selected Educational Statistics from the 1960 U.S. Census of Population, by County

County	Persons 25 years old & older: Median school years completed	Pct. with less than 5 yrs. of school	Pct. with at least 4 yrs. of high school	Pct. with at least 4 yrs. of college	Children in elementary school: Pct. in private school	Persons 14 to 17 yrs. old: Pct. in school	Pct. employed persons classified as professionals, technical, & kindred
Del Norte	10.7	4.1	38.6	4.4	7.2	90.3	7.7
Humboldt	11.0	4.7	42.1	6.2	5.4	90.3	9.2
Lake	10.0	5.3	40.1	6.4	1.5	88.6	11.0
Mendocino	10.8	6.9	41.4	5.5	7.2	87.9	11.6
Modoc	12.0	3.8	50.5	6.9	.3	91.0	8.4
Siskiyou	11.2	5.8	44.3	6.1	2.0	94.8	9.9
Sonoma	11.1	7.4	43.9	6.8	8.6	88.4	12.1
Trinity	11.0	3.8	40.9	6.0	.3	90.2	12.8
California	12.1	5.7	51.5	9.8	10.7	89.7	13.7
United States	10.6	8.4	41.1	7.7	14.4	87.4	11.2

Source: California Statistical Abstract, 1969, Table F-2.

Resources Council. It is a revision of OBERS '68 and OBE '69 projections that incorporates field comments. A Regional population at 52.5 million is projected by 2020. Series D was developed by the California Region Type I Economics Subcommittee and California Department of Finance. This set of projections is based on more recent data and estimates a Regional population of 44.8 million in 2020.

Under all three population levels, the rate of growth in the North Coast is projected to be less than the Region. The percent of the California Region is projected between 1 and 1.5. "Considerating all the population projections presented, it would appear that the 1970 Series D projection is the most likely estimate to occur in the Region. All the other projections mentioned are either based on Series B or Series C birth rate assumptions which are now high estimates" (California Region Appendix IV, Economic Base and Projections, p. 50). Looking at Series D, the population would increase slightly in 1980 and then increase by about 140,000 in the next forty years (see table below).

Projected Population of the North Coast and California Region--Series D

Year	North Coast	California Region	Percent of Region	Percent Increase North Coast	Percent Increase Region
1980	303,530	24,200,000	1.25	-	-
2000	364,475	33,900,000	1.08	20.07	40.09
2020	442,150	44,800,000	.99	21.31	32.15

Under Series D population levels, employment will remain fairly static until 1980 and then increase about 80 percent to 181,282 in 2020 (see table on p. 51). Agricultural employment is projected to decline about 60% by 2020. The increase in employment after 1980 will be primarily in the service sectors, where employment is projected to double by 2020. Employment in the lumber and wood products industries should decline as high-volume old growth stands of timber are harvested and dependence upon second growth stands increases. This decline will be partially offset by a substantial rise in pulp and paper mill employment as this industry grows in importance. Total employment in the forest products industry is projected to decline 47 percent between 1965 and 2020. This projected decline is due to a combination of increased physical productivity per worker and decreased availability of raw material. Lack of major metropolitan market centers, now and in the future, forestall the development of substantial secondary manufacturing facilities that would tend to offset the employment decline in the primary manufacturing industries.

Projected Employment by Major Resource Using Sectors,
North Coast, Series D Population Levels

Year	Total Employment	Agric., Forestry, & Fisheries	Food & Kindred Products	Paper & Allied Products	Other Manufacturing	Other[1]
1980	118,377	5,280	1,610	900	32,269	78,318
2000	142,145	3,852	1,734	1,052	36,176	99,331
2020	181,282	3,009	1,776	1,368	44,143	130,986

[1] Includes Service Industries Sectors.

Per capita income is projected to increase by about 75 percent between 1969-80, 1980-2000, 2000-2020. Earnings per worker are projected to increase by about 40 percent between 1969-80 and 70 percent between 1980-2000 and 2000-2020 (see table below).

North Coast Projected Income

Year	Per Capita Income[1]	Per Worker Earnings[1]
1980	4,963	9,468
2000	8,778	16,409
2020	15,295	28,047

[1] 1967 dollars.

RESOURCE BASED INDUSTRIES

AGRICULTURE

Agriculture was originally established in parts of the basin to satisfy local needs. As transportation and markets improved, agricultural exports expanded providing an additional source of income for portions of the area. Most of the farming is concentrated around Tulelake, the Eureka plains, and the southern interior of the Russian River basin. The range livestock industry is spread throughout the area.

The North Coast comprises a small portion of the Region's agriculture (see table on p. 58). About 10% of all the Region's farms and 6% of all its cropland harvested are in the North Coast. In 1964, North Coast farmers produced about 2 percent of the crop and 5 percent of the livestock value of the Region but had about 13 percent of the Region's land in farms. Average commercial farm size was 927.9 acres, over 1-1/2 times the Regional average, but value of production per commercial farm was $25,313, about half the Region's average. With the North Coastal area, there is a wide range of farm sizes. Humboldt,

Mendocino, Modoc, Siskiyou, and Trinity County farms are well above the Region's average, but Del Norte, Lake, and Sonoma County farms are below. Large farm size and low return per acre is not surprising in light of the small amount of land suitable for cultivation and the high proportion of low valued hay and pasture crops and range livestock.

Selected Farm Characteristics, North Coast and the California Region, 1964

Item	North Coast[1]	California Region[1]	Percent North Coast of State
Number of farms	7,798	81,918	9.5
		1,000 acres	
Land in farms	5,048	38,088	13.3
Cropland harvested	479	8,005	6.0
Irrigated land in farms	527	7,847	6.7
		acres	
Average farm size (all)	647.3	464.9	139.1
Average farm size (commercial)	927.9	614.6	151.0
		dollars	
Value of production/farm	25,313	60,634	41.7
Value of land & buildings/farm	112,114	214,650	52.2

[1] Includes Klamath County, Oregon

Source: California Statistical Abstract, 1969, Table G-21, and 1964 United States Census of Agriculture, California.

Note: Data for the North Coast were derived by adjusting county data to fit North Coast boundaries. For a more detailed discussion of county data, see North Coast Economics Appendix.

Most classifiable farms in the basin are livestock ranches and fruit and nut farms. Compared to the Region, the basin has a smaller portion of field crop, vegetable, fruit and nut farms, and a larger portion of livestock farms. Shown below is a breakdown of North Coast and California Region farms by type for 1964.

Comparing the agriculture of the North Coast to the agriculture of the Region, North Coast crops are lower valued, mainly alfalfa hay, other hay and grain, irrigated and non-irrigated pasture, and range, except for the southern part of the region which grows premium varietal wine grapes, Bartlett pears, Garvenstein apples, prunes, and walnuts. Yields (see North Coast Economics Appendix) are significantly lower for almonds, walnuts, wine grapes, alfalfa hay, and alfalfa seed, somewhat

comparable for apples, potatoes, and wheat, higher for pears, barley, oats, and other hay, and significantly higher for onions. Prices (see North Coast Economics Appendix) follow fairly close to State averages with the exception of Lake County pears and wine grapes which are significantly higher and dry onions which are significantly lower. The difference in price for wine grapes and pears is due primarily to quality, while onion price difference is due to processing.

Farms With Sales of $2,500 or Over

Farm Type	North Coast	California Region
	percent	
Field crop other than fruit, vegetable, and nut	8	10
Vegetable, fruit and nut	28	47
Poultry	2	4
Dairy	12	7
Livestock other than poultry and dairy	37	17
General farms	7	7
Miscellaneous and unclassified	6	8

Source: U.S. Census of Agriculture, 1969.

FORESTRY

The Douglas fir plywood industry was the main contributor to the rapid rise in lumber production in the North Coast from the late 1940's through the mid-1950's, while redwood lumber production pushed to all time highs from 1950 through 1956. The Douglas fir plywood industry continued its phenomenal rate of growth into the 1960's. Recently, production in the area has fallen off, due to a decrease in the production of Douglas fir, even in the fact of continually rising redwood log production. The privately held old-growth reserves of Douglas fir, which occurred primarily on farmer and miscellaneous private holdings in the North Coast, have been rapidly depleted.

In 1965, the North Coast Area had 54 percent of the logging establishments in the California Region, 43 percent of the sawmills and planing mills, 47 percent of the veneer and plywood plants, 3 percent of the millwork and miscellaneous wood products establishments, and 29 percent of the pulp, board, and allied products establishments.

Forest Industry in North Coast Counties 1965[1]	Number of Establishments
Logging	390
Sawmills and Planing Mills	167
Veneer and Plywood Plants	24
Miscellaneous Lumber and Wood Products	30
Pulp, Board, and Allied Products	5[2]

[1] Based on Present and Prospective Development of the Timber Resources and Forest Industries in the California Water Resources Region, by Danial D. Oswald, Pacific Northwest Forest and Range Experiment Station, U.S. Forest Service, May 1969.

[2] There was only one establishment in 1965. Statistics associated with pulp and board products are for 1968 and are based on California Timber Industries: Mill Characteristics and Wood Supply, by Barrette, Gedney and Oswald, published jointly by California Division of Forestry and Pacific Northwest Forest and Range Experiment Station of U.S. Forest Service, 1968.

About 56 percent of the Region's production of sawtimber and all of its production of pulpwood was processed through this area's forest industries in 1965.

Production of Wood in North Coast Counties
1965

Lumber and Veneer Logs	3,334 million board feet
Pulpwood	5 million board feet[1]

About 58 percent of the Region's sawmill capacity, 69 percent of its plywood capacity, and 59 percent of its woodpulping capacity was in this subregion in 1965.

Installed Capacity in North Coast Counties
1965

Sawmills	3,511 million board feet annually
Plywood Plants	1,027 million square feet (3/8-inch basis) annually
Woodpulp Mills	2,045 tons per 24 hours[1]

[1] Ibid.

The value of wood sold in the North Coast Area in the form of standing trees is roughly estimated to have been about 70 million dollars in 1965. The value of this raw material increased approximately 4 times as it was processed through the area's forest industries. The value added by forest industries accounted for 92 percent of the value added by all manufacturing in the North Coast.

Value Added in North Coast Counties
1963

	(millions of 1963 dollars)
Lumber and Wood Products (SIC 24)	226
All Manufacturing	246

Most of the employment and personal income generated by the forest industries in the North Coast is dependent upon its own resource base, almost none being generated by imported raw material. Lumber and wood products, in 1965, employed 23,000 and generated 136 million dollars in personal income.

RECREATION

Recreation is enhanced by the natural beauty of mountains, lakes, streams, beaches, redwood forests, wilderness, and parks. Principal recreation activities include sightseeing, picnicking, camping, hiking, hunting, and fishing.

Probably the biggest scenic attractions in the basin are the giant redwood forests and the rugged coastline. Many visitors come to these sites from outside of the area giving birth to a lively summertime tourist business. The area is only 2-4 hours from the heavily populated San Francisco Bay area which provides much of the demand for its outdoor scenery and related facilities.

An inventory of public and private outdoor recreation facilities in the California portion of the basin in 1969 is shown in the table on page 62. These facilities registered over 13,000,000 visits during 1969.

Summer homes or recreational residences are a significant and fast growing facet of outdoor related recreation in the North Coast Area. It is estimated that there are over 5,000 such residences occupying over 4,000 acres (1968).

Inventory of Public and Private Outdoor Recreation Facilities, California Portion of the North Coast, 1969

Recreation	Area	Unit	Existing Sites
Playfield	333	acres	257
Swimming beach	337	acres	202
Swimming pool	1,127,400	sq.ft.	97
Picnic	966	acres	417
Boat access parking	116	acres	183
Tent camp	2,537	acres	665
Trailer camp	383	acres	215
Cabins & motels	762	acres	
Hotels & lodges	181	acres	
Parking facilities	420	acres	
Group camping	982	acres	271
Ice skating	210	acres	4
Ski slope	317	acres	6
Vista point	52	acres	24
Marina	28	acres	12
Golf course	224	acres	12
General roads	8,047	miles	
Special roads	2,308	miles	
Designated horse trail	3,759	miles	
Designated foot trail	2,071	miles	
Bike path	1	mile	
Land acres	7,620,533		
Wet lands	20,603		
Water	57,907		
Total	7,699,043		

NOTE: Data supplied by California Statewide Planning Division, State of California, Sacramento, October 1969.

The growth of recreational homes has brought economic and social benefits and costs to the region. Benefits may be in the form of increased demand for goods and services which prompts greater employment, albeit mostly in the summer, a larger tax base, and a source of outside money since most summer residents are not from the local area. Costs may be in the form of higher taxes they force on long time local residents, deterioration of the natural environment, increased soil erosion from more roads or the necessity of providing additional utilities.

COMMERCIAL FISHERIES

The North Coast accounts for slightly less than 10 percent of the commercial fish catch (poundage) but provides most of the crab, sole, salmon, sablefish, ocean shrimp, and fish for animal food in the California Region. King and silver salmon, Eureka crabs, and shrimp

are specialities of the area. Total commercial fish landings in 1967 were 42 million pounds valued at 7.2 million dollars. There were 2,460 licensed commercial fishermen in 1967, which is about 25 percent of all commercial fishermen licensed in the Region.

MINING

Mineral resources can be divided into four general categories: mineral fuels, metals, non-metals, and steam. Mineral fuels in the North Coast Area consist of natural gas and subbituminous coal. Metal resources consist of mercury, chromite, copper, gold, manganese, and silver. Non-metallic mineral resources consist of sand, gravel, building stone, and pumice. A geothermal steam resource also occurs at the Geysers in Sonoma County. The following table summarizes the mineral production in 1968 for the North Coast counties.

MINERAL PRODUCTION IN NORTH COAST BY COUNTIES, 1968[1/]

	Sand-Gravel	Stone	Volcanic Stone	Mercury	Natural Gas	Steam	Other[3/]	Total
				(1,000 Dollars)				
Sonoma[2/]	2,500	300	-	600	6	739	400	4,545
Lake[2/]	235	1	229	200	-	-	3	668
Mendocino	574	95	-	-	-	-	2	671
Trinity	297	579	-	409	1,175	-	1	2,461
Humboldt	590	641	-	-	-	-	-	1,231
Del Norte	272	262	-	-	-	-	-	534
Siskiyou[2/]	1,350	235	131	-	-	-	-	1,716
Modoc[2/]	106	4	15	-	-	-	-	125
Total	5,924	2,117	375	1,209	1,181	739	406	11,951

[1/] Principal sources: The Mineral Industry of California in 1968, Mineral Information Service 23:80, 1970.
California Mining Review, Mineral Information Service 23:67, 1970.
California Division of Mines Bulletin 190, Geology of Northern California, 1966.

[2/] Data pertains only to the portions of the counties within North Coastal Area.

[3/] Commodities not revealed in original sources.

FOREST SERVICE PHOTO

Salmon Creek near Myers Flat, California. Road encroaching on stream causing erosion.

FOREST SERVICE PHOTO

Stream bank erosion on Broaddus Creek, Eel River Drainage.

WATER AND RELATED LAND RESOURCE PROBLEMS

In this section, the sources, extent, frequency, and socio-economic consequences of the water and related land resource problems within the North Coastal Area are discussed. These problems include soil erosion and sediment damage, floodwater damage, impaired drainage, water pollution, forest and range fires, and the impairment of natural beauty.

SOIL EROSION AND SEDIMENT DAMAGE

Principal sources of erosion as defined for this study are stream channels, landslides, and watershed slopes (sheet and gully erosion). Sediment is considered in this report to be eroded soil and other material that reaches a live stream. Annual sediment yield by principal erosion source and basin is summarized in the following tabulation:

		Present Annual Sediment Yield (Acre-Feet)				
Basin	Area In Sq.Miles	Streambank Erosion	Land-slides	Sheet & Gully Erosion	Total	Rate Per Sq.Mile
Klamath, Oregon	5,677	650	1/	560	1,210	0.21
Northern Basins	10,795	2,860	1,850	1,230	5,940	0.55
Eel & Mad	4,834	9,258	3,615	1,472 2/	14,345	2.97
Southern Basins	4,109	2,220	940	1,790	4,950	1.20
Total	25,415	14,988	6,405	5,052	26,445	1.04

1/ Minor significance.

2/ Includes erosion from roads.

SCS PHOTO 3-5258-8

Stream bank erosion on the Russian River near Talmage, Mendocino County.

FOREST SERVICE PHOTO

This slide on Cunco Creek is an example of a man-caused slide. Logging with associated road building is the culprit.

RIVER BASIN PLANNING STAFF PHOTO

This slide along Tom Long Creek is apparently naturally caused. Such slides are common in the outside curves of streams where the force of the water eventually undercuts the bank.

FOREST SERVICE PHOTO

SCS PHOTO 3-4566-2

Sheet and Gully Erosion.

SCS PHOTO 3-5463-12

FOREST SERVICE PHOTO

The following tabulation shows the amount of sediment that is directly or indirectly attributed to man's activities:

Present Annual Sediment Yield
(Acre-Feet)

Basin	Directly Influenced By Man[1]	Natural[2]	Total
Klamath, Oregon[3]	484	726	1,210
Northern Basins	2,450	3,490	5,940
Eel & Mad	3,123	11,222	14,345
Southern Basins	1,670	3,280	4,950
Total	7,727	18,718	26,445
Percent	29	71	100

[1] Logging, grazing, roads, and cultivation.
[2] Includes erosion caused by deer.
[3] Amount influenced by man estimated.

Streambank erosion accounts for over half the sediment yielded in the four basins. Most is naturally caused but activities of man, such as road building, logging, and grazing, are responsible for an estimated 3,200 acre-feet.

In the headwaters of the watersheds, small streams erode small quantities of streambank, but because there are many of them they yield a large quantity of sediment. Downstream, gradients become flatter and streams are bordered by terrace, flood plain, and other alluvial areas. These contain easily erodible material and a higher rate of erosion results, except in the few areas where terraces are composed of bedrock.

Most slides and soil creep are caused by natural forces, such as streambank erosion, faults or sheer zones, and deeply weathered geologic units typified by the Franciscan formation. Man-caused slides representing 1/6 to 1/2 of the volume, depending upon the basin, are almost always caused by logging and roadbuilding.

Man's activities have a greater relative influence upon sheet and gully erosion than upon the other two sources. Over half of this erosion is caused by man, mainly in connection with logging, burning, grazing, road building, and road maintenance. Sheet erosion by itself is a minor factor; gullying is responsible for most of this type of erosion.

Without a program sediment yields in the future from sheet and gully erosion and landslides are expected to increase because of man's increased use of watershed lands.

SCS PHOTO 3-4617-4

Babe Woods Irrigation Dam, Dry Creek Watershed, Mendocino County. The delta formed by sediment deposits substantially limits the water storage area.

SCS PHOTO 3-4654-13

Sediment deposits, Weott, California, South Fork Eel River after the 1964 floods.

Some of the main economic and social consequences of soil erosion, sediment transport and deposition are:

1. Effects on land and improvements.

    a. Loss of productive soil in the upstream areas.

    b. Flooding caused by obstruction of drainage ditches and channels.

    c. Covering of rich bottom lands with infertile sediment.

    d. Filling of reservoirs, drainage ditches, and channels.

    e. Loss of recreation facilities, urban developments, and other cultural features.

    f. Impairment of transportation by prohibiting or restricting road traffic.

2. Financial effects.

    a. Cost of replacement of cultural features.

    b. Cost of removal of sediment from agricultural lands and subsequent re-leveling of the land.

    c. Reduced yield of crops, grass, and timber through loss of soil or sediment deposition.

    d. Increased costs of filtering and pumping sediment laden water for municipal and industrial uses.

    e. Increased maintenance costs for roads, reservoir operation, recreation areas, and other facilities.

    f. Decreased value of land.

    g. Loss of income due to decreased fishing opportunities.

3. Other effects.

    a. Loss of fish spawning beds through siltation of gravels.

    b. Impaired fishing due to turbidity.

    c. Decrease in esthetic values.

FLOODWATER DAMAGE

The North Coastal Area experiences floods on an average of every three or four years. Some of the more noteworthy recorded floods are those of February 1915, December 1937, February 1940, January 1943, January 1953, December 1955, February 1958, October 1962, January-February 1963, December 1964, and January 1966.

The December 1955 and 1964 floods are the largest of record. The 1955 storm is estimated to have approached the magnitude of the legendary storm of 1862, while the 1964 storm, which had a recurrence interval of at least 100 years, is estimated to have exceeded it. Both floods caused the same general type of widespread damage, but the 1964 event was greater in magnitude.

The following tabulation presents the estimated flood damages for four storms that were widespread in the last 30 years. This data was obtained from reports by the Corps of Engineers,[1/] and the State Director of Public Works,[2/] and from other data collected by the Corps, Soil Conservation Service, and Forest Service:

Item	Dec. 1964	Dec. 1955	Jan. 1953	Feb-Mar. 1940
Area Flooded (Acres)	215,095	105,210	*	*
Flood Water and Sediment Damages ($1,000)				
Agricultural	25,209	5,338	1,146	686
Forest	37,587	9,614	*	189
Other	140,176	32,269	5,971	1,310
Total	202,972	47,221	7,117	2,185
Lives Lost	24	9	*	0
Estimated Recurrence Interval (Years)	100	50	30	5-10

*Data not available.

1/ U.S. Army, Corps of Engineers, "Report on Floods of December 1964 in Northern California Coastal Streams," (San Francisco District, December 1965). 34 pp. "Report on Floods of December 1964, January 1965." (Sacramento District, October 1965). 116 pp. "Floods of December 1955 and January 1956 in Northern California Coastal Streams." (San Francisco District, June 1956). 137 pp. "Report on December 1955 Floods." (Sacramento District, May 1956). 20 pp.

2/ Frank W. Clark, "Emergency Flood Conditions" (Sacramento, California Department of Public Works, March 28, 1940). 50 pp.

FOREST SERVICE PHOTO

Washout of Highway 139 near Gasquet, California after the 1964 flood.

SCS PHOTO 3-4456-1

CORPS OF ENGINEERS PHOTO

Debris deposited in Crescent City Harbor by the 1964 flood.

CORPS OF ENGINEERS PHOTO

Flood damage at Weott, California, December 1964.

The following average annual damages were estimated by the California Region Framework Study:

Basin	Average Annual Damages ($1,000)[2] Agricultural	Forest	Other	Total
Smith	163	252	442	857
Klamath	681	1,782	1,687	4,150
Trinity	39	771	403	1,213
Mad	170	148	436	754
Eel	707	654	2,131	3,492
Mendocino Coastal	113	1	131	245
Russian	770	0	1,510	2,280
Clear Lake	95	73	263	431
Total	2,738	3,681	7,003	13,422

1/ Adapted from Appendix IX, Flood Control, California Region Comprehensive Framework Study, June 1971.

2/ Damages based on July 1965 prices, economic conditions, and project conditions.

IMPAIRED DRAINAGE

About 691,500 acres have drainage problems, most of which are of short duration, about two weeks or less. Drainage problems occur mostly in soils located in flat valleys or flood plain areas, and the degree of impairment is quite variable.

In the following tabulation, the degree of impairment is divided into three classes and the acreage is shown for each class in California and Oregon:

Degree of Impairment	Affected Areas in Acres California	Oregon
Slight	77,000	57,900
Moderate	44,000	9,000
Severe	140,000	363,600
Total	261,000	430,500

The slight classification includes the soils that have periodic drainage problems, usually only during the winter and early spring months. The moderate classification includes the soils with permanent water tables 4 feet or more below the ground surface, while the severe group includes soils with permanent water tables between two and four feet below the surface.

Under full irrigation, the internal drainage conditions of some soils might become worse, moving more acreage to the moderate and severe classification.

WATER SUPPLY

In general, the North Coastal Area is blessed with adequate water for all present and projected needs. Problems, where they occur, are related to the seasonal distribution of the runoff and the need for storage and distribution systems.

Little Lake Valley, the Shasta-Tulelake area, the Eel River Delta, Round Valley, and Scott Valley are areas where water shortages often occur near the end of the growing season. In some cases, these shortages are partly created by inefficient irrigation systems that use more water than is necessary for optimum crop production. This inefficiency is caused by such things as unlined transmission ditches, long irrigation runs or coarse textured soils, and unleveled fields.

Some distribution problems occur in grazing areas where stockwater is not distributed evenly over rangelands. This leads to an uneven distribution of livestock and poor utilization of the ranges.

RANGE AND FOREST FIRES

Fires in the North Coastal Area, which during the 1960-1965 period burned over 12,000 acres annually, caused an estimated $549,000 damage. On the average, each fire covers 244 acres and causes $46 damage per acre burned. The relative importance of the various causes of fires can be determined with the use of the following table. Most fires result from debris burning, but incendiary fires burn more acreage and cause more damage.

For every 1,000 acres of land protected against fire in the North Coast only one acre burns annually. The comparable rate for California minus the North Coast is five acres per 1,000 protected. A ten-year average (1961-1970) indicates an 18,000 acre burn annually, mostly due to a very active season in 1970 which greatly influences the average. Even with an average annual burn of 18,000 acres, the rate of fire activity in the North Coast is only about 20 percent as much as the rate of fire activity in the rest of the state of California.

FOREST SERVICE PHOTO

Wildfire along U.S. Highway 101 about 1 mile south of Garberville, California, August 1970 being brought under control by the California Division of Forestry Crews.

SCS PHOTO 3-2779-4

Burning to convert timber or brushlands to grass for grazing and to maintain such conversions has been common in the North Coastal Area. Such repeated burning, coupled with heavy grazing, has caused excessive erosion (Dry Creek Drainage, Russian River Basin).

Average Annual Fire Statistics (1960-1965)
For The North Coast River Basins
For Fires 10 Acres in Size or Larger[1/]

Cause	Number of Fires	Area Burned (Acres)	Average Annual Damage (Dollars)
		California	
Lightning	7.7	1,312	64,328
Camper	1.0	99	914
Smoker	6.3	708	45,940
Debris Burning	10.0	2,498	33,735
Incendiary	6.5	5,567	305,854
Machine Use	6.3	770	27,146
Miscellaneous	7.8	537	61,040
Subtotal	45.6	11,491	538,957
		Oregon	
Lightning	0.5	128	1,377
Camper	0.2	34	283
Smoker	0.7	34	933
Debris Burning	0.7	82	317
Incendiary	0.0	0	0
Machine Use	0.3	30	2,883
Miscellaneous	1.0	170	4,523
Subtotal	3.4	478	10,316
TOTAL	49.0	11,969	549,273

[1/] Data developed by the California Division of Forestry for the California Region Comprehensive Framework Study.

Fires in the basins are not a high hazard to human life. The greatest losses from fires occur to timber, watershed, wildlife, and scenic and esthetic values. Short-term benefits from resprouting brush species may enhance deer habitat.

POLLUTION

The North Coastal area has not experienced the serious urban pollution problems encountered in other areas where more intense development has occurred. The following summarizes the present situation with special emphasis on the trouble spots:

CALIFORNIA REDWOOD ASSN. PHOTO

The Klamath River, shown here flowing though privately owned timber land, is characterized by clear, relatively clean water which makes it it one of the best fishing streams in the nation.

FOREST SERVICE PHOTO

Hurdy-Gurdy Creek, tributary to the Smith River is shown here flowing through private lands. It has been rendered useless for fish habitat as well as for almost any other use.

1. Sewage disposal -- 54 percent of the population now utilizes municipal sewage disposal facilities. The other 46 percent and most recreational developments utilize septic tanks with leach fields. These do an adequate job of breaking down and filtering organic substances, but persistent constituents often find their way into surface or ground water.

2. Waste water and solid waste disposal -- These are perhaps the two most troublesome problems. Pulpmills create most of the waste water problems, but discharges from fishing boats, sea food processing plants, and residues from logs stored in the rivers, particularly in the upper Klamath Basin, are also troublesome. Slash accumulation in streams is a serious solid waste disposal problem also.

   The lumber and agricultural industries and municipalities are responsible for most of the solid waste disposal problem. Much of the logging debris is burned, creating air pollution in the process, while agricultural waste, largely a result of feedlot, hog and chicken raising enterprises, is disposed of in other ways. During high water periods, and particularly during flood stages, a great deal of this refuse finds its way into surface or ground waters.

3. Thermal discharge - Cooling water from a conventional fossil fuel power plant, from a nuclear power plant, and from pulp, timber, and wood products industries is discharged into surface waters, generally into Humboldt Bay. These discharges tend to cause localized effects upon marine life by changing water temperatures.

4. Drainage from irrigated land - Return flows with high concentrations of dissolved solids and nutrients cause local water quality problems. Because irrigated land is widely scattered, the overall effect is relatively small, however, in certain localized areas, the effect can be significant.

5. Pollution from natural sources - Turbidity and sedimentation are major problems in virtually all drainages. Local deposits of iron, manganese, and boron cause isolated problems, but surface and ground waters, unless polluted by outside sources, generally meet California standards for class 1 irrigation water, and most drinking water sources meet U.S. Public Health Service standards. Many of man's activities such as logging and road construction aggravate the problem.

IMPAIRMENT OF NATURAL BEAUTY

In the North Coastal Area sheet and gully erosion, landslides, streambank erosion, and road erosion all have a detrimental effect on natural beauty. The seriousness of the effect varies, depending on the amount

of erosion and the setting in which it takes place. In some cases, fires, poor logging, poorly designed, constructed, and maintained roads, overgrazing and other man's practices have left undesirable scars upon the landscape. In addition, silt-laden streams and reservoirs often present an undesirable picture.

FISHERIES

North Coast fishery counting stations over the past three decades (40's, 50's, and 60's) have shown declines of 66 percent in steelhead, 65 percent in silver salmon, and 64 percent in king salmon. The critical links in the fisheries life cycle include the ocean, the estuaries, the lower river and the headwater river areas. All available evidence indicates that the areas most damaged by man's development are the upstream spawning and nursery areas. Dam construction may be a major problem in the future. In the Trinity River Basin, anadromous fish runs have declined and are evidently related to decreased downstream flows and problems with hatchery operation on the existing Trinity Project. Decreases in the numbers of anadromous fish have occurred on all streams in the North Coast, not merely those with dams. It is felt that logging, grazing and road construction have been the major activities decreasing salmonid habitat.

One problem is that caused by logging near streams, which destroys riparian vegetation in the process. The resultant loss of shade has been found to raise water temperatures as much as ten degrees. Such temperature changes are usually harmful to indigenous game fishes. Riparian vegetation supports an abundance of wildlife and is one of the most threatened habitat types in California.

Damage to watersheds and spawning streams from logging, mining, road construction, gravel extraction, grazing, pollution, and other causes has also had a major detrimental effect on the quantity and quality of this key habitat. Major floods, such as the December 1964 flood also cause extensive damage to the fishery resource. There is a need for further study of fishery problems and presently studies are underway on the Trinity and Eel Rivers.

PRESENT AND FUTURE NEEDS FOR WATER AND RELATED LAND RESOURCE DEVELOPMENT

The following presentation concerns only those needs that affect the use and development of water and land resources. There are, of course, needs for many other goods and services in the North Coastal Area. Some of these are discussed in the chapter "Economics" and some in the chapter "Water and Related Land Resource Problems." Others are not discussed because they have little or no bearing on the objectives of the study.

The needs presented in this chapter are based on reports of the California Framework Study, the Forest Survey, and the supporting appendices of this report. The chapter "Recommended Program and Its Impacts" will show the extent to which these needs can be satisfied with USDA assistance.

LAND NEEDS

Land needs are derived from projections of needs for goods and services. The projected need for goods and services from resource based industries divided by the direct output of goods and services per acre indicates the land area needed. The need for goods and services can represent a mix of national, regional, or local populations and their tastes and preferences. For example, the amount of power, transportation, and urban area needed is tied more to the local population than to that of the nation, whereas recreation, wildlife, and industrial needs may be more strongly related to regional populations than to local or national populations. The need for food and fiber is customarily projected for the nation as a whole since the commodities are shipped coast to coast.

FOOD AND FIBER NEEDS

The following tabulation summarizes the acreage needed to produce the North Coast Area's share of national food and fiber requirements. These are projected to three target years, 1980, 2000, and 2020, using the 1970 Series D projections.

	1965	1980	2000	2020
Irrigated Cropland	338,000	410,000	434,000	360,000
Irrigated Pasture	274,000	266,000	239,000	304,000
Subtotal	612,000	676,000	673,000	664,000
Non-Irrigated Cropland	148,000	120,000	84,000	79,000
Total Crop & Pasture	760,000	796,000	757,000	743,000
Grazing Land[1/]	4,207,000	3,878,000	4,402,000	4,451,000
Timber Land[1/]	7,804,000	8,013,000	8,628,000	8,634,000

Source: Appendix VI, Land Resources and Use, California Region Comprehensive Framework Study, June 1971, adjusted to include the Russian River and Clear Lake Basins except where noted in footnote.[1/]

[1/] California Region Framework Study boundaries.

Looking at the near future, irrigated cropland is projected to increase by 72,000 acres. Part of this will probably come from the 8,000-acre decrease in irrigated pasture and 28,000 decrease in non-irrigated cropland. This leaves more than 36,000 acres (assuming some of the above loss is in urban and other uses) of additional irrigated cropland needed by 1980. After 1980, there appears to be enough irrigated pasture land and non-irrigated cropland to meet the projected increase to 2000. The table on page 85 gives a more detailed breakdown of irrigated cropland.

It will be noticed that alfalfa hay and miscellaneous field and truck crops are projected to increase continuously through 2020, hay and grain crops to increase through 1980, and irrigated pasture to decrease through 2000 and then to show a significant increase to 2020. Because of the nature of Type I projections, a more detailed analysis of specific crop acreages and feed requirements for dairy and beef cattle and sheep was done in the North Coast Economics Appendix of this report. These figures are not directly comparable to the Type I projections, but they do give an idea of relative changes to 1980 and 2000. The table on page 86 summarizes the acreage projections for 10 major crops. Total acreage is projected to increase by only 6,000 acres by 1980 and 3,000 by 2000. This increase will come primarily from wine grapes, onions, potatoes, and alfalfa hay. With the exception of wine grapes, these crops are grown primarily in the Klamath Basin and are the same crops that the table on page 85 (California Region Framework Study projections) shows increasing.

Net Irrigated Acres,[1/] North Coastal River Basins,
1965, Projections to 1980, 2000, and 2020
Using Series D Population Levels

Item	1965	1980	2000	2020
		(1,000 acres)		
Hay & Grain	148 (14.7)[2/]	174 (15.0)	175 (19.6)	65 (9.5)
Alfalfa	90 (6.3)	112 (7.2)	127 (8.8)	160 (12.5)
Irrigated Pasture	274 (17.6)	266 (17.8)	239 (17.2)	304 (23.2)
Miscellaneous Field & Truck	36 (1.7)	53 (2.0)	61 (2.4)	65 (2.5)
Deciduous, Vineyard & Tree Nuts	64 (5.3)	71 (5.4)	71 (4.9)	70 (4.5)
Total	612 (6.9)	676 (6.8)	673 (6.9)	664 (6.8)

Source: California Region Appendix IV, Economic Base and Projections, adjusted to include the Russian River and Clear Lake Basins.

1/ Includes double cropping.

2/ Percent of California Region.

Acreage Projections of Major North Coast Crops Using Series D Population Levels and California North Coast County Boundaries[1/]

	1969	1980	2000
Apples	10,630	10,447	10,692
Pears	16,340	13,159	13,655
Prunes	17,050	13,088	10,429
Walnuts	12,210	10,890	11,475
Wine Grapes	20,490	21,982	24,444
Late Summer Onions	2,350	2,937	3,543
Fall Potatoes	18,100	23,203	21,980
Alfalfa Hay	78,180	88,791	92,041
Barley and Wheat	72,950	70,070	69,446
Total	248,300	254,567	257,705

Source: North Coast Economics Appendix.

Because of the importance of the livestock industry to the North Coast and the projected decrease in irrigated pasture to 2000 and grazing land to 1980, livestock feed requirements were also projected in the North Coast Economics Appendix of this report.

Total Feed Requirements[2/]

	Feed Grains	High Protein By-Products	Other By-Products	Hay	Pasture And Range
	(1,000 tons)				(1,000 AUM's)
1961-65 (average)	58,054	24,827	68,192	820,740	4,568
1980	63,399	27,343	74,972	926,052	5,104
2000	79,450	34,438	93,896	1,159,209	6,236

Source: North Coast Economics Appendix.

1/ The North Coast acreage is reported by county boundaries which do vary somewhat, especially Sonoma and Modoc Counties, from the study area. The acreage is just for the California portion of the region.

2/ Includes dairy, beef, and sheep and is based on California North Coast county statistics.

These needs can be satisfied by increased yields within the North Coast, by changes from dryland to irrigated land, or by importation of feed from other regions (with the exception of the pasture and range). With the projected decrease in irrigated passture land and the slight increase of grazed land (200,000 acres) in the year 2000, AUM's will have to be significantly increased on pasture and rangeland. The additional grazed land will supply only about 40,000 AUM's (200,000 x .2 AUM/acre) and the decrease in irrigated pasture land will decrease AUM's by about 350,000 AUM's (35,000 x 10 AUM/acre). Thus, in the year 2000, there appears to be a need for about 2 million additional AUM's (about 1.7 million from the projection and .3 from the decreased acreage) that will have to be supplied by yield increases.

The need to harvest wood in the North Coast is based on that area's potential capacity relative to the nation's potential capacity and the nation's need for wood. The national need is based on the assumption that the price of wood raw material will not increase and that the national population will grow at a series D rate (an annual increase of one percent). The production of wood in the same area for which needs have been allocated is not expected to be large enough to meet the need. Production was estimated by the Forest Survey based on the assumptions that 1) on non-National Forest lands there will be a continuation of current trends in management and cutting levels, with cut and growth brought into balance by the year 2000 following depletion of privately owned old growth, and 2) on National Forest lands there will be a moderate increase in allowable cuts because of increasing management intensity, particularly due to impacts of intermediate harvesting.

Using these assumptions a comparison can be made between expected production (harvest) of wood and the expected need for wood in the North Coastal Area.

Year	Harvest	Need
	(million cubic feet annually)	
1965	531	531
1980	439	535
2000	457	613
2020	500	674

OTHER LAND BASED NEEDS

The needs covered in this section are those that use land, often to the exclusion or drastic modification of other uses. Some of these, such as recreation, are projected considering expected population increases and subsequent demand; others, such as mineral production, are more an assessment of the expected expansion of the industry. No projection is made for wilderness and natural areas because conventional demand analyses do not give accurate predicitions. Setting aside of these areas is dependent upon factors, such as public pressures and political actions, that are impossible to predict. The following is a tabulation of the future needs for land for the uses that can be projected.

	1965	1980	2000	2020
		(acres)		
Developed Recreation[1]	97,000	98,000	100,000	102,000
Mineral Production[1]	2,000	4,000	6,000	8,000
Fish & Wildlife Areas[1]	154,000	181,000	181,000	181,000
Urban & Industrial[1]	52,000	54,000	55,000	62,000
Transportation & Utilities[1]	228,000	267,000	305,000	309,000
Recreation Homes[2]	3,800	4,900	7,500	11,000

Source: Appendix VI, Land Resources and Use, California Region Framework Study, June 1971.

WATER NEEDS

The firm surface-water yield from all projects active in the North Coastal Subregion in 1965 is 3.35 million acre-feet per year. Of this quantity, 2.40 million acre-feet is for local use and 0.95 million acre-feet is for export to the Sacramento Basin and San Francisco Bay Subregions.

The total adjusted mean annual streamflow for the entire subregion is 27.4 million acre-feet. The mean annual natural runoff for the entire subregion is 29.3 million acre-feet. The difference between these two values, 1.9 million acre-feet represents the average annual depletion of natural runoff. That depletion consists primarily of an average export of 1.1 million acre-feet of water and that part of the 1.4 million acre-feet of applied water that is consumptively used. The small value of the depletion attests to the limited development of the water resources of the subregion.[3]

The following is a tabulation of the water that will be needed to satisfy future demands, based upon the 1970 Series D projections of irrigated cropland and municipal and industrial use.

	1980	2000	2020
		(acre-feet)	
Municipal & Industrial[1]	115,300	115,300	113,800
Irrigation[4]	1,757,600	1,749,800	1,726,400

1/ California Region Framework Study boundary.
2/ Currently 100,000 acres of land are being subdivided. A relatively small percentage of this land is expected to undergo significant development.
3/ Appendix V, Water Resources, California Region Comprehensive Framework Study, June 1971.
4/ Based on a farm delivery demand water coefficient of 2.6.

There will be additional relatively minor needs for water for recreation facilities, stock water, and other uses, but these are not expected to greatly affect the need for development. There is also a need to increase summer and fall flows in many streams to preserve or improve salmon and steelhead fisheries.

The Klamath Basin needs for irrigation water were analyzed in detail using a linear programming model because of the apparent increases in irrigated acreage of crops grown in the Basin. It was estimated that for the three major California valleys in the Klamath Basin the following firm supply for 1970 could profitably be used assuming a 6 percent return for management, a 6 percent interest charge for land, the resource and market restraints in the North Coast Economics Appendix and free water.

	Total Needed	Current Surface Water	Current Ground Water	Additional Water Needed
		(acre-feet)		
Butte Valley	97,000	48,500	48,500	0
Scott Valley	61,800	24,720	6,800	30,280
Shasta Valley	87,600	26,280	8,760	52,560

Source: North Coast Economics Appendix.

The 30,280 and 52,560 acre-feet of water in the Scott and Shasta Valleys represent more of the physical need. The exact quantity and source of water (i.e., surface water impoundment or ground water pumping) which would economically be needed will have to consider the cost of ground water pumping and the cost of surface water development together with the derived demand curves for water. For example, if water cost $10 per acre-foot, the following quantities would be needed.

	Total Needed	Current Surface Water	Current Ground Water	Additional Water Needed
		(acre-feet)		
Butte Valley	97,000	48,500	48,500	0
Scott Valley	41,800	16,720	4,180	20,900
Shasta Valley	11,000	3,300	1,100	6,600

It can be seen that the Scott Valley would have a preference over the Shasta Valley for water development (ground and surface) for agricultural use assuming there are no adverse environment-quality effects.

The linear programming model was run for 1980 allowing market restraints and yields to increase and assuming all other conditions remaining at 1970 levels.

1980 Water Needs

	Total Needed	Future Surface Water	1970 Ground Water	Additional Water Needed
		(Water Cost, $0 per acre foot)		
Butte Valley	98,160	49,080	48,500	580
Scott Valley	73,200	29,280	6,800	37,120
Shasta Valley	88,800	26,640	8,760	53,400
		(Water Cost, $10 per acre foot)		
Butte Valley	98,160	49,080	48,500	580
Scott Valley	48,900	19,560	4,180	25,160
Shasta Valley	11,500	3,450	1,100	6,950

When water was priced at $10 per acre-foot, there was a significant decrease in water needed by agriculture in the Scott Valley and especially the Shasta Valley. Any proposed future water resource projects will need to consider water cost, ground and surface water availability, and any adverse effects on fish and wildlife.

WATERSHED PROTECTION AND FLOOD PREVENTION PROJECTS (PUBLIC LAW 566)

The Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, as amended) authorizes the expenditure of federal funds through the U.S. Department of Agriculture to plan and carry out a program for the development, use, and conservation of the Nation's soil and water resources. It is under this authority that River Basin Studies and more detailed watershed work plans are prepared. The primary purpose of potential projects must be flood prevention, irrigation, or drainage; other purposes such as recreation, fishery enhancement, municipal and industrial water supply, and other water management measures may also be included. The act stresses the adequate treatment of the upstream watersheds aided by structural measures. Except for rights-of-way and utility relocation, the program provides all installation costs for flood prevention projects and up to 50 percent of installation costs for all other purposes, except municipal and industrial water supply.

The Adobe Creek Project in Lake County is the only completed PL 566 watershed project in the North Coastal River Basins. This project, which covers an area of 21,500 acres, consists of land treatment, primarily intensified fire protection, two floodwater retarding structures, with fishery development in one, and intermittent channel improvement.

The only other PL 566 watershed project approved for operations is the Central Sonoma Project in Sonoma County. This project covers an area of 50,000 acres. The work plan provides for structural measures consisting of four floodwater retarding structures, two diversion structures, and approximately thirty-four miles of channel improvement, including riprap, concrete linings, and vegetative bank protection. This project is presently under construction and is more than eighty percent complete.

RESOURCE CONSERVATION DISTRICT PROGRAMS

Resource Conservation Districts are legally constituted units of State government that administer soil and water conservation work within their boundaries. Each district is governed by an elected board of local people, resident land owners or operators, and have the authority to enter into working agreements with governmental agencies, other resource conservation district, and with private interests.

The following conservation districts in the North Coast Area cover about 84 percent of the study area.

Resource Conservation District	County	SCS WU OFFICE
California		
Elk Creek	Glenn	Willows
Gold Ridge	Sonoma	Santa Rosa
Santa Rosa	Sonoma	Santa Rosa
Sotoyome	Sonoma	Santa Rosa
Mendocino County	Mendocino	Ukiah
Westlake	Lake	Lakeport
East Lake	Lake	Lakeport
Napa County	Napa & Sonoma	Napa
Trinity County	Trinity	Redding
Siskiyou	Siskiyou	Yreka
Shasta Valley	Siskiyou	Yreka
Butte Valley	Siskiyou	Tulelake
Lava Beds	Siskiyou & Modoc	Tulelake
Central Modoc	Modoc	Alturas
Oregon		
Langell Valley	Klamath	Klamath
Poe Valley	Klamath	Klamath
Klamath	Klamath	Klamath
Lakeview	Lake	Lakeview
Fort Rock-Silver Lake	Lake	Lakeview
Jackson	Jackson	Medford

There are no resource conservation districts in Humboldt and Del Norte Counties.

District programs, which are carried out through cooperative agreements with the Soil Conservation Service and individuals or groups of landowners, provide aid in the development of conservation plans for: (1) the treatment and use of cropland, rangeland, woodland, and forest, including the problems incident to their conversion to urban uses; (2) the improvement and protection of stream channels; and (3) the development of water for irrigation, livestock, and recreation. Increasing emphasis is being given to the planning for the management and protection of the steep and eroding mountain slopes. Technical services to the cooperating landowners dealing with agronomy, biology, range management, and recreation are also available through the district's program.

Additional technical services for treatment and use of forests are provided by the California and Oregon Division of Forestry cooperating with the U.S. Forest Service.

The following table illustrates the conservation land treatment measures applied to date in the ten RC&D's which lie wholly or principally within the North Coastal Area in California.

LAND TREATMENT APPLIED TO DATE[1/]
NORTH COASTAL RIVER BASIN

Item	Unit	Number
Brush Control	Acres	3,994
Conservation Cropping System	Acres	74,114
Critical Area Planting	Acres	10,779
Crop Residue Management	Acres	40,899
Dam, Multiple-Purpose	Acre-Feet	105,043
Deferred Grazing	Acres	154,089
Dike and Diversion	Feet	330,311
Drains and Drainage Field Ditch	Feet	834,712
Drainage Land Grading	Acres	985
Drainage Main or Lateral	Feet	1,007,060
Grading Stabilization Structure	Number	315
Irrigation Canal or Lateral, Irrigation Ditch and Canal Lining, Irrigation Field Ditch	Feet	1,349,848
Irrigation Land Leveling	Acres	52,405
Irrigation Pipeline	Feet	1,195,771
Irrigation Storage Reservoir	Acre-Feet	65,011
Irrigation System: Sprinkler, Surface and Subsurface, Tailwater Recovery	Number	2,039
Irrigation Water Managment	Acres	44,860
Land Adequately Treated	Acres	763,326
Land Smoothing	Acres	10,363
Minimum Tillage	Acres	27,170
Open Channel	Feet	964,433
Pasture and Hayland Management	Acres	173,251
Pasture and Hayland Planting	Acres	100,252
Pipeline	Feet	22,135
Ponds	Number	539
Proper Grazing Use	Acres	371,093
Range Seeding	Acres	30,833
Rotation-Deferred Grazing	Acres	9,255
Streambank Protection	Feet	564,636
Structure for Water Control	Number	1,740
Tree Planting	Acres	24,802
Well	Number	777
Wildlife Habitat Management	Acres	84,552
Wildlife Wetland Management	Acres	80,810
Woodland Improved Harvesting and Woodland Improvement	Acres	153,287

1/ Cumulative to 6/30/70. Includes only selected representative practices from the principal Soil Conservation Districts in the North Coastal River Basin. Does not include Oregon protion of basin.

CONSERVATION OPERATIONS (PUBLIC LAW 46)

Established in 1935 by the 74th Congress, PL 46 established a national soil and water conservation policy and created the Soil Conservation Service (SCS). The law directed the SCS to develop a program to control and prevent soil and water losses and to reduce flooding and sediment hazards.

Under this authority the SCS cooperates with the RCD's in carrying out their programs (described above).

In addition, under this authority, the SCS has other far ranging responsibilities including: providing leadership in the conduct of the National Cooperative Soil Survey Program, the operation of the Plant Materials Centers, and an information program.

WATER STORAGE AND FLOOD PREVENTION RESERVOIRS

Existing reservoirs include those of several agencies, both public and private. Following is a list of water storage reservoirs having an original capacity of 1,000 acre-feet or more.

SCS PHOTO 3-3885-7

Adobe Creek, a PL 566 project constructed by the Soil Conservation Service. To the right is the Highland Dam. On the left is the Adobe Creek Dam. Their combined flood storage capacity is 6000 acre feet. Channel improvements were completed after this photo was taken (see photo on page 95).

SCS PHOTO 3-4386-1

Adobe Creek channel safely carrying away flood waters. This portion of the creek is out of the area shown in the photo on page 94.

CORPS OF ENGINEERS PHOTO

Lake Mendocino, with the dam in the right foreground, was constructed by the Corps of Engineers. It provides 48,000 acre feet of flood storage on the Russian River.

SCS PHOTO 3-5735

Trinity Dam, 30 million yard earth fill dam, 1/2 mile long and 1/2 mile wide at the base.

FOREST SERVICE PHOTO

Clair Engle Lake (formed by Trinity Lake provides 2.5 million acre feet of storage and a drawdow of 8-10 feet.

Water Storage and Flood Prevention Reservoirs

Reservoir	Stream	Began Operating	Capacity (Ac.Ft.)	Name of Owner
	Eel-Mad River Basin			
Pillsbury	Eel River	1921	93,700	PG&E[1/]
Ruth	Mad River	1961	51,200	HBMWD[2/]
	Russian Mendocino Coastal and Clear Lake Basin			
Mendocino	E. Fk.Russian R	1959	122,500	C/E
Clear Lake	Cache Creek	1914	314,000	Clear Lake Water Co.
Highland	Highland Creek	1962	3,500	Lake County FCWCD[3/]
Matanzas	Matanzas Cr.	1963	1,500	Sonoma Co. FCWCD[4/]
Santa Rosa	Trib. Santa Rosa Cr.	1963	3,550	Sonoma Co. FCWCD
	Klamath, Trinity, and Smith River Basins			
Dwinell	Shasta R.	1928	50,000[5/]	Montague WCD
Iron Gate	Klamath R.	1962	58,000	Pacific Power & Light Co.
Copco No. 1	Klamath R.	1922	77,000	Pacific Power & Light Co.
Clair Engle	Trinity R.	1960	2,500,000	BR
Lewiston	Trinity R.	1963	14,600	BR
Clear Lake	Lost River	1910	527,000	BR

(Footnotes following page)

(For table on previous page)

1/ Pacific Gas and Electric Company.
2/ Humboldt Bay Municipal Water District.
3/ Lake County Flood Control and Water Conservation District.
4/ Sonoma County Flood Control and Water Conservation District.
5/ Original capacity was 72,000 acre-feet, but because of fear for the safety of the dam, the reservoir is kept at a lower level.

Sweasey Reservoir on the Mad River, which began operating in 1938, filled with sediment by about 1955 and became useless as a storage reservoir. The Sweasy Dam was subsequently removed in 1971 to rehabilitate salmon and steelhead runs in the Mad River. Ruth Reservoir, farther upstream now partially regulates flow of the Mad River for domestic and municipal uses in the Humboldt Bay Area (principally Eureka and Arcata). Ruth Reservoir has no flood control storage.

Clear Lake (Lake County) is the largest natural lake within the boundaries of the state, and it is regulated by a small dam on Cache Creek, which is the outlet for the lake. The lake has a surface area of about 68 square miles. The dam regulates the outflow of the lake and the water is used for irrigation in Yolo County. By court decree, the lake is allowed to fluctuate between the limits of 0 to 7.56 feet. Within these limits, the lake has a useable storage capacity of about 314,000 acre-feet.1/

Many more reservoirs having a capacity of less than 1,000 acre-feet have been built in North Coastal River Basins. These include farm ponds and reservoirs on individual ranches. Some are quite large and are important to individual land owners for irrigation and stock water. Morris Reservoir, owned and operated by the Pacific Gas and Electric Company, has a capacity of about 600 acre-feet and is the main source of water for the town of Willits. Flood control benefits are minimal for these reservoirs. Of the reservoirs in the basin, only those in the Russian River and Clear Lake Basins are single purpose flood control storage projects. The following is a list of those facilities in existence in 1965.2/

1/ State of California, Department of Water Resources, Clear Lake-Cache Creek Basin Investigation. Sacramento, March 1961.

2/ Appendix IX, Flood Control, California Region Comprehensive Framework Study, June 1971.

Reservoir	Stream	Max. Flood Control Capacity (1,000 Ac.Ft.)	Constructing Agency
1/ Mendocino	Russian River	48.0	Corps of Engineers
1/ Santa Rosa	Santa Rosa Creek	3.2	SCS
1/ Matanzas	Matanzas Creek	1.3	SCS
1/ Piner	Piner Creek	0.2	SCS
1/ Brush	Brush Creek	0.1	SCS
2/ Highland	Highland Creek	2.4	SCS
2/ Adobe	Adobe Creek	0.6	SCS

1/ Russian River Basin.
2/ Clear Lake Basin.

Although not operated as flood control storage projects, the Trinity Project and the Klamath Project, both of which are operated by the Bureau of Reclamation, provide incidental flood control benefits through surcharge storage.

Other existing flood control measures include flood forecasting and minor levee and channel projects. River and flood forecasts for the Basin are prepared by the Federal State River Forecast Center in Sacramento. River stage forecasts are made for key gaging stations. Flood warnings are also given to susceptible areas. Major levee projects are on the Eel River, Redwood Creek Deltas, and on the Mad River near Blue Lake. Some levee and channel work has also been done on East Weaver Creek near Weaverville and Middle Creek near Lakeport.

COOPERATIVE STATE AND FEDERAL FORESTRY PROGRAMS

Within the basins of the North Coast, several state and federal forestry programs are in progress. The programs, which are based upon federal laws, are designed to promote better forest management on land outside the national forests.

The cooperative Fire Control Program, authorized by Section II of the Clarke-McNary Act (1924), is administered by each cooperating state. It allows the USDA Forest Service to assist the State in providing a satisfactory level of fire protection on non-federal forested and watershed land, with the assistance coming in the form of matching

funds for fire protection and technical guidance where needed. Historically, the states of California and Oregon have provided most of the funds in this cooperative program.

The Cooperative Fire Control Program provides the framework for excellent cooperation between fire control agencies. This cooperation is expected to continue and will become increasingly important as the use of this region intensifies and the fire hazard increases.

The total cost for this program in fiscal year 1969 was over $31,100,000 for all of both states; federal funds amounted to over $1,500,000 of this total. In the past several years the federal contribution has been about six percent of the total expenditure. The states also have cooperative programs with non-federal agencies to which they contribute additional money.

This program can be the basis for the increased fire protection needed to hold future fire losses to the present low levels on private lands.

The Cooperative Tree Nursery Program, authorized by Section IV of the Clark-McNary Act (1924) helps the State Forester provide forest tree seeds and seedlings to the private sector at a nominal cost. This nursery stock is used for reforestation, windbreaks, and erosion control projects under other State-Federal cooperative programs. This program can be an effective tool for accomplishing the land treatment program.

To help the states of California and Oregon operate their four nurseries under this program, the federal government can contribute up to half of the net cost of operation. In fiscal year 1969, the cost of operating these nurseries was shared as follows:

Federal contribution	$ 5,500
State contribution	$ 64,500
Sales to private land owners	$282,000

Under the Cooperative Forest Management Act, as amended by PL 92-288, Service Foresters, employed by the California and Oregon State Divisions of Forestry and partially financed from federal funds on a matching basis, are assigned to provide technical assistance to small private timberland owners. These Service Foresters advise the owners on methods of improving management to obtain optimum returns from timber resources and recreation development by applying multiple-use concepts. The local headquarters of the Service Forester and the North Coastal area are served as follows:

Office	Area Covered
Santa Rosa	Sonoma and Lake Counties
Willits	Mendocino County
Fortuna	Del Norte, Humboldt, and Western Trinity Counties
Redding	Modoc, Shasta, Siskiyou, and Eastern Trinity Counties
Klamath Falls	Klamath and Lake Counties in Oregon

This program has been highly successful in the North Coastal Basins, but there is a need for considerably more services and program development than the people in these five offices can provide.

No statistics are available specifically for the study area, but for the entire States of California and Oregon in fiscal year 1969, the Federal share for the Cooperative Forest Management Program mounted to $85,700, while almost $167,700 was contributed by the two states. Since about 28 percent of the private timberland in both states is within the study area, it seems logical that about the same proprotion of money was spent in this area -- about $24,000 of federal and $47,000 of state funds. It is estimated that at least two or three times as much of this type of service is actually needed. Service Foresters could be a great help in accomplishing the forestry portions of the land treatment program.

Under the General Forestry Assistance Program, the Forest Service provides direct technical assistance to industrial foresters, forestry consultants, landowners holding over 5,000 timbered acres, other federal agencies, and participating states. Through this program, the Forest Service provides technical forestry services that are unavailable from other State-Federal cooperative programs. The assistance is directed toward developing, managing, and utilizing forest resources under multiple use principles so as to contribute to the nation's economy, natural beauty, and resource wealth. Another objective is to correlate and interpret forest research findings for application of forested land.

NATIONAL FOREST DEVELOPMENT AND MULTIPLE USE PROGRAMS

Approximately 10,500 square miles, of the study area are within ten national forests, and almost 90 percent of this area is in the northern basins of California and the Klamath Basin of Oregon.

Beginning with the Organic Act of June 4, 1897, as amended, and several subsequent statutes and regulations, the National Forests have long been managed for multiple-uses which became recognized by law with passage of the Multiple-Use Sustained Yield Act of June 2, 1960.

Although the principles and concepts of multiple-use management were developed before the passage of the Multiple Use-Sustained Yield Act, the Act provides a congressional mandate for this type of management. Under this law, the Forest Service is directed to administer the national forests for outdoor recreation, range, timber, watershed, and wildlife and fish purposes. Multiple-use management guides have been prepared by each Forest Service Region. In the guide for the Northern California Subregion, six broad management zones -- the Crest, Front, General Forest, Travel Influence, Water Influence, and Special Zones -- are delineated, and general management directions are provided for each. In the guide for Oregon there are five resource zones. These are the Alpine, Upper Forest, Principle Forest, Grass-shrub, and Special Resources Zones. There are also two landscape-management units within the resource zones. These are the Foreground and the Background. The Foreground is that portion of the forest which is occupied or viewed directly from roads, trails, streams, and recreation developments. The Background is that portion of the forest which is viewed at a distance beyond the foreground. Management objectives in establishing these designations are to maintain and enhance the beauty and other aesthetic qualities of the forest environment.

Using the principles outlined in these guides, multiple-use plans that provide broad management direction have been developed for each Ranger District. Within the framework of the multiple-use plans, functional plans are written to cover the development and use of each resource and to provide day-to-day management guidance.

RESOURCE CONSERVATION AND DEVELOPMENT PROJECTS

The U. S. Department of Agriculture, by authority of Public Law 87-703, the Food and Agriculture Act of 1962, gives technical and financial help to local groups in conserving and developing natural resources. Also, it helps project sponsors seek funds and services from other Federal agencies and from state and local sources. The Soil Conservation Service has leadership for the USDA in this program.

Resource Conservation and Development (RC&D) projects usually include more than one county. Each area should be large enough to include the resource developments needed to meet project objectives but small enough for effective local leadership to prepare and carry out a project

plan. Local people initiate and run them. Applications for a project are sent to the USDA through one or more legal sponsors -- a qualified local group such as a conservation district, a county governing body, a town, a local or state agency, or a public development corporation.

Each Resource Conservation and Development Project has its own unique goals, but typically they aim to:

1. Develop land and water resources for agricultural, municipal, or industrial use and for recreation and wildlife.

2. Provide soil and water resource information for a variety of land and water uses including farming, ranching, recreation, housing, industry, and transportation.

3. Provide conservation measures for watershed protection and flood prevention.

4. Accelerate the soil survey where it complements project measures.

5. Reduce pollution of air and water.

6. Speed up conservation work on individual farms, ranches, and other private holdings and on public land.

7. Improve and expand recreation facilities; promote historical and scenic attractions.

8. Encourage existing industries to expand and new ones to locate in the area and thus create jobs; encourage industries to process products of the area.

9. Improve markets for crop, livestock, and forest products.

At the present time, there are no RC&D Project areas in the North Coastal River Basins Area.

RURAL ENVIRONMENTAL ASSISTANCE PROGRAM

The Agricultural Stabilization and Conservation Service (ASCS) administers REAP, formerly the Agricultural Conservation Program (ACP), which shares with farmers the cost of carrying out soil and water conservation measures essential to (1) protecting agricultural lands from wind and water erosion, (2) improving the productivity of the nation's agricultural resources, (3) protecting and improving the source, flow, and use of water for agricultural purposes, and (4) enhancing the quality of the environment by helping to abate the pollution of soil, water, and air. Highest priority is given to conservation measures promoting public benefits. Through this program, the Federal Government offers

to share with farmers the cost of conservation practices which they would not carry out to the needed extent on their own initiative and with their own resources.

Averaging about 50 percent of the cost of a practice, this cost-sharing is provided in the form of conservation materials, services, and financial assistance. Costs are shared for those approved conservation practices on individual farms most urgently needed, for which cost-sharing is requested and for which the work is performed effectively according to recognized standards.

The REAP and its accomplishments are reviewed annually by county and state agencies, and recommendations are made to improve the program. Conservation practices are selected to meet local and national needs. Each county has a list of approved REAP practices adapted to its particular needs.

The amount of REAP cost-sharing assistance provided in California under the 1971 REAP was over $3.5 million. The amount for the principal North Coastal Counties in 1971 is shown in the following table:

SCS PHOTO 3-4816-15

Typical of REAP cost-sharing projects is this stock watering tank. Several similar ones have been installed on North Coast farms and ranches.

USE OF 1971 REAP FUNDS BY COUNTY[1/]
NORTH COASTAL RIVER BASINS

California County	Number of Participating Farms	Acres Benefited	Total Assistance to Farmers
Del Norte	15	1,135	$ 8,696
Humboldt	154	13,066	65,834
Lake	26	332	22,622
Mendocino	96	3,129	96,697
Modoc	94	17,600	85,995
Siskiyou	85	6,282	95,728
Sonoma	89	1,706	71,962
Trinity	6	347	2,416
Total	565	43,597	449,950

The average 1971 assistance was $796 per farm or $10.32 per acre.

FARMERS HOME ADMINISTRATION LOAN PROGRAMS

The Farmers Home Administration (FHA) provides loan programs and financial and advisory assistance for:

1. Farmers to purchase and improve real estate; to buy livestock, equipment, and other essentials; and to finance forestry and recreational enterprises.

2. Farmers and rural residents to construct, purchase, or improve homes, farm service buildings, housing for domestic labor, and rental housing.

3. Groups of farmers and rural residents to develop and improve rural water supply systems, waste disposal systems, and livestock grazing land. In addition, loans can be made to organizations to finance the local share of the cost of installing Watershed Protection (Public Law 566) works of improvement.

1/ 1971 Annual Report, California, ASCS, USDA.

4. To enable low-income rural families to increase their incomes and make a modest improvement in their standards of living through loans for both agricultural and business enterprises.

In addition, FHA provides assistance to rural communities for planning, financing, and executing a complete program of economic development, including assistance in locating and using services of non-USDA programs to solve problems. FHA makes grants for comprehensive areawide water and sewer plans and development grants as well as loans for construction of water and sewer systems. All of these are limited to communities not over 5,500 population. The loan programs do not compete with those of other lenders, and financial management assistance accompanies each loan. Landowners who qualify for loans through private lending organizations are not eligible for loans under the FHA programs. The maximum loan available under the Soil and Water Conservation Loan Program is $60,000. The following table summarizes FHA activity by county in the North Coastal River Basins of California.

Summary - All FHA Programs
North Coastal River Basins

California County	1971 Fiscal Year		Total Outstanding 12/31/71	
	Loans or Grants	Amount	Number of Loans	Amount
Del Norte	3	$ 43,000	19	$ 197,000
Humboldt	15	310,000	134	1,436,000
Lake	19	565,000	55	723,000
Mendocino	25	411,000	39	508,000
Modoc	12	177,000	54	703,000
Siskiyou	11	310,000	73	1,270,000
Sonoma	78	1,737,000	246	3,569,000
Trinity	1	13,000	17	223,000
Total	164	$3,566,000	637	$8,629,000

The average loan or grant during fiscal year 1971 totaled $21,744 and the average loan outstanding as of 12/31/71 was $13,546.

AGRICULTURAL EXTENSION SERVICE

The Agricultural Extension Service (AES) provides educational and informational services to landowners and operators and maintains an office in each county in the Basins. University of California and Oregon State University farm advisors help the agricultural interests to keep up-to-date on the latest agricultural advances and to improve farming operations. Livestock improvement and field trials on crops and fertilizers are part of AES activities. Financing is cooperative, with the University furnishing 60 percent, the County 20 percent, and the federal government 20 percent of the funds for these services. The farm advisors' offices and counties they served are listed below.

Farm Advisors' Location	County
California:	
Orland	Glenn
Santa Rosa	Sonoma
Kelseyville	Lake
Ukiah	Mendocino
Eureka	Humboldt, Del Norte
Weaverville	Trinity
Yreka	Siskiyou
Alturas	Modoc
Oregon:	
Medford	Jackson
Klamath Falls	Klamath
Lakeview	Lake

THE RECOMMENDED PROGRAM AND ITS IMPACTS

The total recommended program for the North Coast is summarized in this chapter. All of the elements in this program are eligible for assistance under one or more of the legislated authorities held by the U.S. Department of Agriculture and described in the previous chapter. The amount of assistance that can be provided for the recommended program by these authorities is presented in the following chapter.

RECOMMENDED PROGRAM

The recommended program is estimated to cost $159,393,000 to install and $6,207,000 annually to operate after it is installed. The installation period would last for 20 years and the useful life of the more durable elements would be 100 years. The average annual equivalent cost of installing and operating the program over its useful life would be $15,014,000 when the installation is financed at 5-1/2% interest.

Two-thirds of the installation cost and nine-tenths of the operating cost of the recommended program is for land treatment measures that rehabilitate watersheds and thus offer protection for downstream structures and other values. The land treatment measures accomplish this objective by reducing the rate of water released, by reducing the amount of erosion on the land and by reducing sediment yield. These processes are achieved by improving the density of vegetation on grass and brush covered land and by improved methods of location, design, installation and management of roads on forested land to reduce erosion and better manage excess runoff.

One-third of the installation cost and one-tenth of the operation cost of the recommended program is for structural measures to store water for flood prevention and irrigation and to drain land with high water tables. A summary of installation and operating costs is presented in the tables on the following two pages. Further detail of the land treatment measures is found in Appendices No. 1 and No. 2 of this report. Further detail of the structural measures is found in the individual Watershed Investigation Reports on file in the State Office of the Soil Conservation Service in Berkeley, California. Since the structural measures are not covered in the appendices of this study a brief description of each project follows.

EARLY ACTION ON WATERSHED INVESTIGATION REPORTS

Of the 48 potential watershed projects investigated, 43 are in California and 5 are in Oregon. The map "Location of Watershed Investigations" and the table "Status of Watershed Investigations," shown on the following pages, present the location and recommended actions for each of the potential watershed projects. The first category in the table called "Early Action" includes all the structural measures in the recommended

Cost of Structural Measures in Recommended Program[1/]

Watershed	Acres	Cost in 1,000 Dollars	
		Installation	Annual Operation Maintenance and Replacement
Klamath Basin			
2. Big Springs	14,400	363	15
4. Butte Valley	186,900	1,086	10
6. East Fork Scott River	170,750	5,354	30
7. Etna Creek	27,500	4,381	37
8. French Creek	28,500	2,273	32
9. Grenada Ranch & Dam	324,300	5,209	134
11. Cottonwood-Hornbrook	66,000	350	4
12. Kidder Creek	50,100	7,796	71
13. Moffett Creek	105,800	4,465	41
Trinity Basin			
21. Hayfork Valley	170,600	2,597	34
Eel Basin			
26. Little Lake Valley	48,000	1,665	58
Mendocino Coastal Basin			
32. Anderson Valley	140,800	5,467	45
Russian Basin			
34. Feliz Creek	28,600	190	9
35. Green Valley	24,000	5,474	69
43. Sausal Creek	13,100	2,401	18
Clear Lake Basin			
44. Burns Valley	7,700	570	3
45. Clover Valley	20,000	1,151	9
46. Forbes Creek	2,200	343	1
48. Seigler Springs	7,500	2,490	33
Total	1,436,750	53,625	653

1/ Summarized from Watershed Investigation Reports.

Cost of Land Treatment Measures in Recommended Program[1/]

Component	Quantity	Units	Installation Cost ($)	Annual Operation Maintenance and Replacement Cost ($)
A. Grass Covered Lands				
Seeding	574	square miles	7,274,000	179,000
Fertilization	695	square miles	10,438,000	666,000
Fencing	995	miles	1,350,000	70,000
Stockwater Developments	353	number	353,000	17,000
Brush control	54	square miles	173,000	14,000
Tree planting	217	square miles	9,722,000	-
Technical Services	2,163	square miles	1,800,000	45,000
Total			31,110,000	991,000
B. Brush Covered Lands				
Brush removal	139	square miles	8,896,000	-
Tree planting	139	square miles	1,779,000	-
Weeding	139	square miles	1,334,000	-
Technical Services	139	square miles	300,000	-
Total			12,309,000	-
C. Forest Covered Land [2/]				
Surfacing Roads	685	miles	50,815,000	3,854,000
Improved Drainage from Roads	550	miles	7,755,000	433,000
Relocation of Roads	86	miles	2,580,000	196,000
Outsloping Roads	4,353	miles	1,024,000	80,000
Road Closure	875	miles	175,000	-
Total			62,349,000	4,563,000
Total Cost of Land Treatment Measures in Recommended Program			105,768,000	5,554,000

[1/] Summarized from Appendices No. 1 and No. 2 -- Sediment Yield and Land Treatment Measures, North Coastal River Basins.

[2/] This program involves only National Forest land.

SCS PHOTO 3-5138-6

Two of the most erodible soils in the North Coastal area are the Yorkville and Laughlin series. Over grazing and subsequent erosion have rendered these sites almost totally unproductive. Extensive rehabilitation combined with rest is needed to restore productivity and halt sediment yield. Above: Yorkville and Laughlin soils along Mail Ridge Road. Below: Yorkville soils near Blue Rock. Both in the Eel River Drainage.

SCS PHOTO 3-5138-5

FOREST SERVICE PHOTO

FOREST SERVICE PHOTO

Proper drainage requires elaborate and expensive facilities. Culverts must be designed to carry water completely over the fill area to drainage channel below.

Above: Gasquet-Orleans Road, Six Rivers National Forest. Road is also hard surfaced.

Left: Access road, Six Rivers National Forest. Drainage newly installed.

Status of Watershed Investigations

Watershed Name	County	Early Action	Future Potential	Suited to Other USDA Programs
Klamath Basin				
California				
1. Antelope Creek	Siskiyou			X
2. Big Springs	Siskiyou	X		
3. Boles Creek	Modoc			X
4. Butte Valley	Siskiyou	X[1/]		
5. Dry Lake Drainage Area	Modoc			X
6. East Fork Scott River	Siskiyou	X		
7. Etna Creek	Siskiyou	X		
8. French Creek	Siskiyou	X		
9. Grenada Ranch and Dam	Siskiyou	X		
10. Harris and Ikes Creeks	Siskiyou			X
11. Cottonwood-Hornbrook	Siskiyou	X		
12. Kidder Creek	Siskiyou	X		
13. Moffett Creek	Siskiyou	X		
14. Prather Creek	Siskiyou			X
15. Willow Creek	Siskiyou		X	
Oregon				
16. Lake of the Woods	Klamath			X
17. Merrill	Klamath			X
18. South Fork Sprague River	Klamath-Lake			X
19. Swan Lake	Klamath			X
20. Wood River	Klamath			X
Trinity Basin				
21. Hayfork Valley	Trinity	X		
Smith Basin				
22. Rowdy Creek	Del Norte			X
Eel Basin				
23. Jacoby Creek	Humboldt		X	
24. Elk River	Humboldt		X	
25. Ferndale	Humboldt		X	
26. Little Lake Valley	Mendocino	X		
27. Loleta	Humboldt		X	
28. Lower Mad River	Humboldt		X	
29. Round Valley	Mendocino		X[2/]	
30. Salmon Creek	Humboldt		X	
31. Yager Creek	Humboldt		X	
Mendocino Coastal Basin				
32. Anderson Valley	Mendocino	X[1/]		
33. Garcia River	Mendocino			X
Russian Basin				
34. Feliz Creek	Mendocino	X		
35. Green Valley	Sonoma	X		
36. Laguna	Sonoma			X
37. Mark West Creek[3/]	Sonoma	-	-	-
38. McDowell Creek	Mendocino			X
39. Mill Creek	Sonoma			X
40. Potter Valley	Mendocino			X
41. Redwood Valley	Mendocino			X
42. Robinson Creek	Mendocino			X
43. Sausal Creek	Sonoma	X		
Clear Lake Basin				
44. Burns Valley	Lake	X[1/]		
45. Clover Valley	Lake	X		
46. Forbes Creek	Lake	X		
47. Manning Creek	Lake			X
48. Seigler Springs	Lake	X		

1/ An existing preliminary investigation report.
2/ A large water resource development project may inundate this potential project area.
3/ A preliminary investigation is in progress by the Sonoma County Flood Control District.


SMITH RIVER BASIN
KLAMATH RIVER BASIN
MAD RIVER BASIN
EEL RIVER BASIN
MENDOCINO COASTAL BASINS
TRINITY RIVER BASIN
CLEAR LAKE BASIN
RUSSIAN RIVER BASIN
KLAMATH RIVER BASIN
OREGON
CALIFORNIA
DEL NORTE
SISKIYOU
KLAMATH
LAKE
JACKSON
MODOC
TRINITY
HUMBOLDT
MENDOCINO
SONOMA
GLENN
Crescent City
Eureka
Fort Bragg
Willits
Ukiah
Santa Rosa
KLAMATH FALLS
Tuleloke
PACIFIC OCEAN
LEGEND
Eorly Action Projects
Future Potentiol Projects
Suited to Other USDA Programs
LOCATION OF WATERSHED INVESTIGATIONS
NORTH COASTAL RIVER BASINS
CALIFORNIA AND OREGON
SEPTEMBER 1972
SCALE 1:1,600,000
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
M7-E-22605C-N

program. The "Early Action" projects are all economically feasible and are expected to receive strong local support in the next 10 to 15 years. The other categories in the table are not included in the recommended program for one or more of the following reasons:

1. Some are not expected to receive enough local support within the next 15 years;

2. Some have problems that are beyond the scope of USDA authorities and would require action by other agencies first; and

3. Some would require major changes in land use and farming practices that are not expected to occur within the next 15 years.

Each of the 19 "early action" projects in the recommended program are described on the following pages. Only the structural measures are covered. Land treatment needs within project areas are accomplished by the measures described in Appendices No. 1 and No. 2 of this report, and already summarized in this chapter.

Big Springs Watershed

The Big Springs Watershed drains an area of 14,400 acres tributary to Big Creek, which flows into the Shasta River. Proposed structural measures in this project include all the facilities needed to deliver 9,350 acre-feet of water each year from Big Springs and four wells to the 2,700 acre service area. Three new wells and pumping plants will be required. The project will replace two existing pumping plants, install over 8,000 feet of pipeline, 17,600 feet of concrete lined ditch with water controls and turnouts.

Butte Valley Watershed

The watershed encompasses about 186,900 acres in the Klamath River Basin, Siskiyou County, California. About two-thirds of the area is located in the Klamath National Forest. Butte Valley is a closed basin with no outlet and portions of it are inundated each year by flood waters. In recent years, a high water table has formed in the valley, decreasing crop production and creating alkali problems in the topsoil. Surface flows in Butte Creek are inadequate for irrigation during the summer and fall months and must be supplemented by costly pumping from ground water sources.

The existing Dry Lake Area near Orr Mountain would be increased in size to store 9,000 acre-feet of floodwater. An outlet channel would provide about 7,500 acre-feet of irrigation water annually into the existing irrigation system. A master pipeline collection system to drain on-farm tile drain systems would lower the water table to six feet below the ground surface.

East Fork Scott River Watershed

East Fork Scott River Watershed, an area of 170,750 acres, drains into the South Fork of the Scott River just above the community of Callahan, California, where the two forks form the Scott River. About 40 percent of the watershed is located in the Klamath National Forest. Proposed structural measures in this project include a multiple purpose flood prevention-irrigation-recreation storage structure, about 30 miles of concrete-lined channel to deliver irrigation water to 8,820 acres of irrigable land, basic recreation facilities which include picnic, camping, sanitation facilities, a boat launch, dock, and parking area, and fish mitigation measures. The reservoir will have 20,000 acre-feet of irrigation storage (5,000 acre-feet will be shared with flood prevention), 1,800 acre-feet of sediment storage, and 2,000 acre-feet of recreation storage.

Etna Creek Watershed

Etna Creek Watershed encompasses 27,500 acres which drain into the Scott River at Etna, California. About 40 percent of the watershed is located in the Klamath National Forest. A multi-purpose dam is proposed on Etna Creek for flood control, irrigation, and recreation. Planned in conjunction with the dam are channel improvement on Etna Creek for flood prevention, 14 wells and pumping plants, an improved irrigation distribution system, and basic recreation facilities for boating, picnicking, swimming, fishing, and camping. The increased availability of irrigation water coupled with protection from flooding will enable farm operators to increase their net income on 4,330 acres of farmland. The 86-acre recreation pool and park development will provide facilities for an estimated 30,100 visitor-days use at the site. Wildlife habitat lost by inundation will be mitigated by habitat improvements in other areas of the watershed. Sediment storage will be provided for 1,200 acre-feet of sediment.

French Creek Watershed

French Creek Watershed drains an area of 28,500 acres into the Scott River three miles southeast of Etna, California. About one-third of the watershed is located in the Klamath National Forest. A multiple purpose dam is proposed for flood prevention, irrigation and recreation. An irrigation distribution system, basic recreation facilities and deer mitigation measures are other features of the project. The reservoir will store 4,700 acre-feet of irrigation water, including 3,000 acre-feet used jointly for flood prevention, 1,600 acre-feet of sediment storage, and 1,000 acre-feet of recreation storage. About 2,500 acres of land will be provided with a more dependable irrigation supply system. The recreation pool will have a 137 acre surface. Fifteen camp sites, 10 picnic sites, and one boat launching ramp and dock will be developed. An annual total of 34,250 visitor-days is the projected full recreational use at this site.

Grenada Dam and Ranch Watershed

Grenada Dam Watershed encompasses nearly 244,600 acres and the Grenada Ranch Watershed contains approximately 79,700 acres. Together they form the upper portion of the Shasta River Basin, which is a tributary to the Klamath River. About 40 percent of these two watersheds is located in Klamath and Shasta National Forests. The water development portion of the project is located in the Grenada Dam Watershed Area, while the service area is in the Grenada Ranch Watershed. Irrigable land in the service area totals 13,720 acres, including 6,050 acres presently under full or partial irrigation.

A multi-purpose irrigation-recreation-municipal water supply structure with an associated recreation area is proposed on Shasta River, with an irrigation distribution system for the watershed. The storage capacity of 22,400 acre-feet would provide 19,900 acre-feet for irrigation, 1,000 acre-feet for recreation, 600 acre-feet for sediment, and 900 acre-feet for municipal water supply. Included in the project are six irrigation pump plants, 34 miles of canals, and 40 turnouts. Proposed recreational facilities include 30 developed camp sites, 25 developed picnic sites, and one boat launching ramp. To mitigate the loss of steelhead and salmon spawning habitat above the dam, a spawning channel and trapping and holding facilities would be built at the base of the dam.

Cottonwood-Hornbrook Watershed

Cottonwood-Hornbrook Watershed encompasses approximately 66,000 acres and is tributary to the Klamath River in Klamath County, Oregon. About 20 percent of the watershed is located in the Klamath National Forest. Of the 1,235 irrigated acres in the watershed, about 935 acres have an inadequate supply after July 1 each year.

The proposed project consists of building a diversion ditch to transport water from an adjoining watershed to supplement the flow in Cottonwood Creek to replace the existing diversion ditch, which is inadequate to carry the necessary flow. The diversion structure on Cottonwood Creek that diverts water into the irrigation distribution system is also inadequate and would be replaced with a better structure.

Kidder Creek Watershed

This watershed drains an area of 50,100 acres and outlets into the Scott River one mile southwest of Fort Jones, California. About 20 percent of the watershed is located in the Klamath National Forest. Proposed in this project are a multiple purpose flood prevention, irrigation, and recreation storage structure, 54 wells and irrigation pumping plants, an irrigation distribution system, channel improvements, basic recreation facilities and fish and deer mitigation measures. The reservoir will include 4,000 acre-feet of irrigation storage (3,500 acre-feet will be joint storage with flood prevention), 800 acre-feet of sediment storage, and 1,000 acre-feet of recreation storage. Basic recreation facilities include five developed campsites, four developed picnic sites, a swimming beach, one boat launching ramp and dock, necessary sanitation, access roads and parking.

Moffett Creek Watershed

Moffett Creek Watershed drains an area of 105,800 acres into the Scott River one mile west of Fort Jones, California. About one-quarter of the watershed is located in the Klamath National Forest. Proposed in this project are a multiple purpose flood prevention-irrigation-recreation reservoir, an irrigation distribution system, irrigation wells and pumping plants, channel improvement, basic recreation facilities and fish and deer mitigation measures. The reservoir would have 9,000 acre-feet of irrigation storage (including 1,500 acre-feet used jointly for flood prevention), 1,800 acre-feet of sediment storage, and 1,000 acre-feet of recreation storage. The recreation pool would be 100 surface acres and the basic recreation facilities would consist of eight developed camp sites, six developed picnic sites, a swimming beach, a boat launching ramp and dock, and necessary sanitation, access roads and parking.

Hayfork Valley Watershed

Hayfork Valley Watershed encompasses about 170,600 acres in the Trinity River Basin, Trinity County, California. About 90 percent of the watershed is located in the Trinity National Forest. About 1,300 acres of irrigated land have an insufficient water supply during the summer and fall months and another 800 acres could be irrigated if sufficient water were available.

The project would consist of a multi-purpose reservoir on Carr Creek near its junction with Hayfork Creek. The total capacity would be 7,200 acre-feet and would provide the following storage: irrigation - 5,600 acre-feet, and recreation - 1,600 acre-feet. An additional 1,400 acre-feet of storage capacity is required for the 100-year sediment accumulation. Water releases from the dam would be pumped out of Hayfork Creek at several points along the valley and distributed through pipeline systems to the irrigation service areas.

Little Lake Valley Watershed

Little Lake Valley Watershed encompasses 48,000 acres of land. It is located on Outlet Creek, a tributary of the Eel River, in Mendocino County, California. Restrictions in Outlet Creek cause flooding at the lower end of Little Lake Valley and prevent full use of its agricultural capacity. Only 200 acres of cropland are presently under irrigation, but another 4,000 acres could be irrigated if an additional 9,000 acre-feet of water were available.

The proposed project would enlarge the channel on 2.4 miles of Outlet Creek immediately downstream of Little Lake Valley and enlarge 3.8 miles of channels within the present flood plain to assure adequate drainage of floodwaters. Irrigation water development would consist of 21 wells scattered around the valley and 12.3 miles of pipeline for a main distribution system.

Anderson Valley Watershed

The watershed encompasses 140,800 acres of land in the upper portion of the Navarro River drainage, Mendocino County, California. Increased production could be obtained on the partially irrigated and dry cropland areas in the valley if additional irrigation water supplies were available. Existing recreation facilities in Mendocino County are being used at about their full capacity and in the near future, additional facilities will be needed. Increased municipal water supplies will be needed for the residential areas and fire protection in the future.

The proposed project consists of a 6,000 acre-foot reservoir on Mill Creek and diversion dams and pipelines on Robinson and Anderson Creeks to bring additional water into the reservoir. The reservoir would store 3,000 acre-feet of water for irrigation, 1,000 acre-feet of water for municipal use, and 2,000 acre-feet of water for recreation. A pipeline distribution system would furnish sufficient pressure to use sprinkler irrigation systems.

Feliz Creek Watershed

Feliz Creek Watershed encompasses about 28,600 acres of land tributary to the Russian River in Mendocino County, California. At present, about 700 acres of land are irrigated, but another 425 acres could be irrigated if additional water were available.

The proposed project consists of 4 wells scattered throughout the valley to develop 1,250 acre-feet of water to irrigate the additional 425 acres of land. About 4.1 miles of pipeline and a booster pump would distribute the water to the new service area.

Green Valley Watershed

Green Valley Watershed encompasses 24,000 acres of land that drains into the Russian River in Sonoma County, California. Although there are 10,000 acres of potentially irrigable land in the watershed, only about 200 acres are presently fully or partially irrigated.

The proposed project consists of three multi-purpose reservoirs to store 13,100 acre-feet of water for irrigation and recreation. About 9,600 acre-feet of storage would be used to irrigate 4,300 acres of land and 19 miles of pipeline, with 14 pumping plants, would provide a high pressure distribution system for the service areas. The combined recreation storage in the three reservoirs would be 3,500 acre-feet. Sediment storage is provided for 390 acre-feet of sediment.

Sausal Creek Watershed

Sausal Creek Watershed encompasses about 13,100 acres of land and is a tributary to the Russian River in Sonoma County, California. Floodwater damages occur mostly on agricultural land with minor damages to urban developments, channel improvements, roads, and bridges. An additional irrigation water supply is needed to fully irrigate 1,614 acres that is

now dry-farmed or is only partially irrigated. Water-based recreation has a good potential in this area. The proposed project consists of a 7,000 acre-foot, multi-purpose reservoir for floodwater storage, irrigation water supply, and recreation. About 4,300 acre-feet would be developed to irrigate 1,614 acres of cropland and 9 miles of pipeline would distribute the water to the service area. A 1,000 acre-foot lake would be available for recreation. Sediment storage is provided for 1,200 acre-feet of sediment.

Burns Valley Creek Watershed

The watershed encompasses about 7,700 acres of land and is a tributary to Clear Lake in Lake County, California. If irrigation water were available, walnut production could be increased on 376 acres of dryland orchards and another 24 acres of irrigable land could be planted to orchard. An adequate supply of water is available from Clear Lake, but high boron content makes its use for walnut growing questionable.

The project would consist of two reservoirs with a total storage of about 1,300 acre-feet to furnish irrigation water for 400 acres of walnut orchards. A high pressure distribution system would be installed to allow sprinkler irrigation. Arrangements would need to be made to obtain rights to Clear Lake water now appropriated by downstream users.

Clover Valley Watershed

Clover Valley Watershed encompasses 20,000 acres and is a tributary to Middle Creek and Clear Lake Basin in Lake County, California. About 70 percent of the watershed is located in the Mendocino National Forest. Of the approximately 2,000 acres of irrigable land in the watershed, about 500 acres have only a partial irrigation water supply and another 500 acres could be irrigated if additional water were available.

The proposed project consists of a 2,600 acre-foot reservoir to store water for irrigation and 5.4 miles of pipeline to distribute irrigation water to the service areas. Sediment storage is provided for 550 acre-feet of sediment.

Forbes Creek Watershed

Forbes Creek Watershed encompasses 2,200 acres of land and is a tributary to Clear Lake in Lake County, California. Floodwater damage occurs almost annually on residential, commercial, and public facilities, mostly within the Lakeport City Limits, and on some agricultural land.

The project would consist of a 250 acre-foot floodwater retarding reservoir and improving the existing Forbes Creek Channel. Sediment storage is provided for 50 acre-feet of sediment.

Seigler Springs Watershed

Seigler Springs Watershed encompasses 7,500 acres of land and is a tributary to Clear Lake in Lake County, California. Only 10% of the irrigable crop

land in the watershed is presently irrigated, using water from Clear Lake. While the municipal and industrial water supply from Clear Lake is adequate for present needs, the quality of water is poor.

The project would consist of a 12,200 acre-foot reservoir to store a water supply for irrigation, municipal, and industrial needs. About 3.9 miles of pipeline would distribute irrigation water to 500 acres of potentially irrigable land. Sediment storage is provided for 600 acre-feet of sediment.

Forty percent of the 1.4 million acres included in watershed projects is located within National Forest boundaries.

IMPACTS OF RECOMMENDED PROGRAM

The impacts of the recommended program are listed in the table on the following page. As the table shows, the program, if installed, will affect virtually all of the resources and their use. The most pronounced land use effects will be upon agriculture, grazing, timber production and wildlife. The chief economic effect will be to increase production of commodities, which will lead to higher employment and an increase in the annual value of gross output. A major value of the program is its effect upon all aspects of the environment. Soil erosion and sediment yield will be decreased, flooding will be less of a threat, and open space will be preserved and, in some cases, enhanced. As a major side effect, esthetics will be improved as remedial and development projects and better land management reduce or eliminate the scars of soil erosion, landslides, flooding and man's activities, such as road-building, over-grazing, and improper logging, that have caused problems in the past.

Only the impacts that directly affect the North Coastal area have been evaluated. There is no doubt, however, that the improvements that would result if the program is followed would have far-reaching secondary effects in other parts of the two states and the nation. Most obvious of these would be the economic effects caused by the production of food and fiber for processing and sale outside the area. Not so obvious is the attraction of a better managed, more esthetically pleasing and safer North Coastal area to tourists, vacationers, hunters, and fishermen.

ENVIRONMENTAL IMPACTS

The environmental impact of each measure proposed has not been evaluated, however, it is estimated that overall effect of the program on the environment will be favorable.

When detailed plans are formulated, each segment of the program will be studied in accordance with the National Environmental Policy Act of 1969.

Summary of Impacts of Recommended Program
on Reducing Problems and Meeting Needs[1/]

	Amount	Units
Flood water storage capacity	23,700	Acre-Feet
Sediment Storage Capacity	12,000	Acre-Feet
Flood channel protection	8.2	Miles
Annual Flood Damage Reduction	455,000	Dollars
Annual Reduction in sediment after:		
1) Installation	979	Acre-feet
2) Distant future	6,006	Acre-feet
Range wildlife habitat		
Increase	193	Square Miles
Decrease	217	" "
Enhanced	927	" "
Brush wildlife habitat		
Decrease	332	" "
Forest wildlife habitat		
Increase	356	" "
Water surface	1,362	Acres
Arable land drained	7,700	Acres
Irrigable land served fully	69,000	Acres
Irrigation water storage capacity	96,100	Acre-feet
Farms directly affected	929	Number
Annual Production of forage	690,800	A.U.M.s
Annual Production of Wood	47	Million cubic feet
Increase in Employment (Primary & Secondary)	1,000	Man-years/year
Increase in Annual Value of Gross Output (Primary & Secondary)		
Crops, trade & services	+25.5	Million Dollars
Forage	14.2	" "
Wood	6.6	" "
	46.3	" "

1/ In units of measurements comparable to statements of problems, needs, and of the economy, in foregoing chapters.

HYDROLOGIC IMPACTS

Hydrologic studies indicate that the land treatment program will reduce runoff from 2-year recurrence internal storms of up to 10 days. The amount of reduction that could be realized from the various remedial programs varied from about 5 to 30 percent in the area to be treated. Management guidelines would also reduce runoff, but to a lesser degree. These reductions would be most noticeable on the smaller streams. During periods of heavy rains and major flooding, the effect would be negligible.

The watershed structures proposed for the program will provide 23,700 acre-feet of flood storage and 12,000 acre-feet of sediment storage in addition to the accelerated land treatment program. Flood channel protection will be accomplished with structural measures on 8.2 miles of stream course. These projects will have a major effect on the streams which they protect and a minor effect on the larger downstream rivers and other small streams. The result of these hydrologic impacts is to reduce the annual value of flood damage by an estimated 455 thousand dollars.

SEDIMENT REDUCTION AND WATER QUALITY IMPACTS

Implementation of the total program will reduce sediment yield about 6,000 acre-feet. Adherence to the management guidelines will account for over 5,000 acre-feet of that reduction. It is estimated that this portion of the reduction can be achieved with little or no additional costs to the landowner. The remaining reduction, slightly less than 1,000 acre-feet, will result from the remedial measures in the land treatment portion of the program. This reduction will accrue almost equally from the portions of the program designed to increase production of forage and timber and the portions of the program designed specifically to reduce sediment. In the former case, sediment reduction is incidental to the main goal of improving production and, in the latter case, sediment reduction is the main goal of the program, although there are other important benefits.

Although some reduction in sediment will result almost immediately after the implementation of the program, the full reduction will not result until after the 20-year installation period. The program will have its greatest effect upon sheet and gully erosion but will also result in reduction in sediment yield from streambanks and landslides. The extent of these chain reaction effects has not been estimated. Virtually all of the effects of the program will concern the part of the sediment yield that is presently being caused by man, with little or no effect upon naturally caused sediment yields.

Overall water quality is not expected to be materially affected by the recommended program, with the exception that periodic sedimentation which occurs during periods of major runoff would be reduced somewhat on smaller streams. The chemical composition of the water should remain unchanged with the exception of a possible minor increase in nitrogen caused by fertilizer used in the private grassland program. This slight increase would have a negligible effect on water quality.

Future Annual Sediment Yields By Source

	Area Sq.Mi.	Sediment Sources in Acre-Feet Per Year				
		Stream-banks	Land-Slides	Sheet & Gully	Roads	Total
Without Program						
Northern Basins[1]	10,795	2,860	2,330	1,330	[2]	6,520
Eel & Mad Basins	4,834	9,258	4,500	1,321	144	15,223
Southern Basins	4,109	2,220	1,180	2,690	[2]	6,090
Total	19,738	14,338	8,010	5,341	144	27,833
With Program						
Northern Basins[1]	10,795	2,400	1,745	705	[2]	4,850
Eel & Mad Basins	4,834	7,406	3,615	989	97	12,107
Southern Basins	4,109	1,870	885	2,115	[2]	4,870
Total	19,738	11,676	6,245	3,809	97[2]	21,827

[1] Does not include the Oregon portion of the Klamath River Basin (5,677 square miles)

[2] Sediment yield from roads included under sheet and gully erosion.

Of minor impact will be a decrease in the future supply of sand for beach replenishment.

WILDLIFE IMPACTS (OPEN SPACE)

Three basin wildlife habitats, distinguishable by their open space attributes, are affected by the recommended program. These are range, brush, and forest. The impact of the program will be an increase of forest wildlife habitat of 356 square miles, a decrease in brush wildlife habitat of 332 square miles, and a net decrease in range wildlife habitat of 24 square miles. About 927 square miles of range wildlife will be enhanced in terms of vegetal abundance. Water surface used for waterfowl resting areas will be increased by about 1,362 acres. Streamside wildlife habitat will be reduced by the amount of stream length covered by the increased water surface. The 8.2 miles of channelized stream will support a different and less abundant wildlife population. Fewer fish eggs will be lost from sediment deposition in streams, spawning beds and aquatic food production will be improved, and the fish population will increase. In general, as the vegetal cover is improved, wildlife food and habitat will increase and game populations will respond to the better environment.

This is a definite need for further study as to the impact of the recommended program on wildlife of all kinds and also for creative solutions to problems created by such an extensive program. For instance, the problems related to a large-scale fertilization program in an area of heavy rainfall and runoff need additional study as well as the problem of providing spawning salmon and steelhead access to spawning areas on tributaries planned to have dams. It is recommended that such studies be undertaken in the detailed planning stage.

PRODUCTION IMPACTS

The production of food and feed crops will be increased by the addition of 69,000 acres of fully irrigated land. This will be made possible by the increase in irrigation water storage capacity of 96,100 acre-feet. About 7,700 acres of irrigable land will result from draining wetlands, and some of it will come from land that is now irrigated only during the first part of the growing season due to lack of storage capacity. The program will help increase the production of food and feed on 929 farms.

The production of forage on range lands will be increased by 690,800 animal unit months and the production of industrial round-wood will be increased by 47 million cubic feet.

This increased production of food feed and fiber will provide for additional employment of about 1,000 man-years annually.

MONETARY IMPACTS

The 19 proposed watershed projects were estimated to create an increase in annual value of gross output (primary) of $19.8 million in crops and

$1.7 million in trade and services. Outdoor recreation use increases are mainly reflected by the trade and service increase. The remedial programs were estimated to create an increase in annual value of gross output of $9.3 million in livestock and $5.6 million in lumber.

An input-output (I-O) model of the basin was used to estimate the secondary economic effects of these programs on the rest of the economy of the basin. This was done by feeding the primary impacts (changes in the gross value of output) into a variation of the basin I-O model to find the resultant change in primary final demand for that sector. The changes in final demands were then run through the I-O model to estimate the indirect changes in the output of all sectors to support the additional final demand.

The direct plus indirect changes in gross value of output were found to be $25.5 million for the watershed programs, $14.2 million for the livestock remedial program, and $6.6 million for the lumber remedial program. The multiplier effects were found to be 1.19 for the watershed programs, 1.53 for the livestock remedial program, and 1.18 for the lumber program. The I-O model treated household sector as exogenous, so the multiplier effect is significantly lower than if households were included in the model.

OPPORTUNITIES FOR ASSISTANCE FROM U. S. DEPARTMENT OF AGRICULTURE

The United States Department of Agriculture has the authority and responsibility, under various laws, to promote wise use of land and water resources through land treatment and construction programs. The following is a summary of the USDA's ability to assist in the installation of the program recommended in the preceding chapter. Federal money is used to fund all programs on federally owned land. Programs on private land are assumed to be funded with federal money by the amounts authorized in existing laws without the use of Resource Conservation and Development Programs.

The first tabulation shows the total installation cost of the recommended program by land ownership and major program element and the amount that can be funded by the USDA. If RC&D authority were created to cover the North Coastal Area, the federal contribution to private land portions of the recommended program would be an additional $3,729,000.

The second tabulation shows the recommended program in terms of its average annual cost equivalent when it is fully installed. The average annual cost equivalent is derived by adding the annual operation, maintenance and replacement costs of the fully installed program to the annual repayment charge on the installation debt. The debt is assumed to be carried at 5-1/2% interest over 100 years. If RC&D authority were created to cover the North Coast, the federal contribution to the private land portions of the recommended program would be an additional $206,000 per year.

Total Installation Cost of Recommended Program

Program	Total Installation Cost		
	Federal ($1,000)	Non-Federal ($1,000)	Total ($1,000)
Federal Land			
Road Measures	62,349	-	62,349
Land Treatment	4,816	-	4,816
Total	67,165	-	67,165
Non-Federal Land			
Structural Measures	28,646	24,979	53,625
Land Treatment	21,976	16,627	38,603
Total	50,622	41,606	92,228
Total	117,787	41,606	159,393

Annual Cost of Recommended Program[1/]

Item	Installation Cost ($1,000)	Operation, Maintenance and Replacement Cost ($1,000)	Total Cost ($1,000)
Federal Land			
Road Measures			
Federal Funds	3,445	4,563	8,008
Land Treatment Measures			
Federal Funds	266	-	266
Total, All Measures			
Federal Funds	3,711	4,563	8,274
Non-Federal Land			
Structural Measures			
Federal Funds	1,583	-	1,583
Non-Federal Funds	1,380	653	2,033
Sub-Total	2,963	653	3,616
Land Treatment Measures			
Federal Funds	1,214	-	1,214
Non-Federal Funds	919	991	1,910
Sub-Total	2,133	991	3,124
Total, All Measures			
Federal Funds	2,797	-	2,797
Non-Federal Funds	2,299	1,644	3,943
Total	5,096	1,644	6,740
Total, All Land			
Federal Funds	6,508	4,563	11,071
Non-Federal Funds	2,299	1,644	3,943
GRAND TOTAL	8,807	6,207	15,014

[1/] 5.5% interest rate - 100 year life.

In summary, the USDA currently has authority to fund 74 percent of the installation cost of the recommended program without the use of RC&D authority and 76 percent with RC&D authority.

The following sections describe the USDA authorities which may be called upon to assist in various portions of the recommended program and also assess the adequacy of current funding.

WATERSHED PROTECTION AND FLOOD PREVENTION PROJECTS (PL 566)

Pertinent data and costs for each of the projects recommended for early action are shown in the previous chapter. The total cost of these projects would be about $54 million and the cost share would be $29 million federal and $25 million state or local.

Under the definition of early action, all of these projects would have to be started within a 15-year period and would generally be completed within five years, making the construction period 20 years long. The average annual cost for the federal share during this period would be about $1.4 million. This does not include the cost of land treatment measures which would be required as parts of the various projects. In recent years, the funds allotted for construction of the authorized PL 566 projects in California have only been about 30 percent of the amount needed to install projects authorized for construction within a normal 5-year period.

RESOURCE CONSERVATION DISTRICT PROGRAMS

About 88 percent of the privately owned grassland in the basins is within the 19 resource conservation districts. Each district is in a position to take leadership in implementing the land treatment program within its jurisdiction. Areas not covered by resource conservation districts can be assisted through other USDA authorities, such as PL 46.

SOIL CONSERVATION SERVICE CONSERVATION OPERATIONS (PL 46)

Technical services needed to install the recommended remedial measures, especially those in the grassland program, could be provided by the SCS under its Conservation Operations Program. The services for this program are estimated to be about $73,000 a year during the 20-year installation period and $36,000 a year thereafter.

COOPERATIVE STATE AND FEDERAL FORESTRY PROGRAMS

The Cooperative Fire Control Program can be used to help the states and local fire organizations maintain the present high level of fire protection on private lands. To maintain that level will require more intensive efforts as fire prevention and control problems are expected to intensify as more use is made of the area.

The Cooperative Tree Nursery Program, the Cooperative Forest Management Act, and the General Forestry Assistance Program can provide funds and expertise to help accomplish the forestry portions of the recommended program.

To successfully complete the recommended program will require federal funding substantially higher than has been the case in the past.

NATIONAL FOREST DEVELOPMENT AND MULTIPLE USE PROGRAMS

The Forest Service has adequate legal authority and technical expertise to install the recommended program within the framework of its regular management and development. Generally, the only real lack is funds and, in some cases, setting of priorities.

Almost all of the program in the Northern Basins for converting public grassland to timber and about 25 percent of the program for converting brushland to timber is designed for national forest land. These involve about 40 and 35 square miles, respectively. There are an additional 39 square miles of national forest brushland to be converted to timber in the Eel and Mad Basins. Reforestation expenditures on this type of land in the past few years has totaled about $174,000 annually on the North Coast portions of the national forests involved. At that rate, it would take 28 years to complete the recommended program.

All of the recommended road program involves national forest roads. Rehabilitation of these roads is estimated to cost over $62 million, with an additional annual maintenance cost of $4.5 million. Funds presently allotted in the four national forests allow for little or no rehabilitation. Maintenance allocations average about $130.00 per mile of road while the program calls for a maintenance expenditure of about $700 per mile.

It is difficult to ascertain precise deficits in the funds allocated to do an adequate road rehabilitation and maintenance job. Final decisions must be made based upon a detailed study of the individual roads involved. However, it seems certain that present funds are inadequate and that these Forest Service roads will continue to yield sediment for many years to come if funding is not increased.

Many of the management guidelines for logging, grazing, wildfire, recreation, game habitat management, and road construction are standard

procedure in national forests. When failures in accomplishment occur, they are often tied to lack of funding or staffing, unforeseen events, pressures from outside groups, or lack of control of the resources. An example of the latter is the inability to achieve a balance between game habitat and game populations because game harvesting regulations are determined at another level of government and are not necessarily tied to the condition of the range or the game herd.

RESOURCE CONSERVATION AND DEVELOPMENT PROGRAMS

Through resource conservation and development projects, technical services and funds could be made available to plan and install the remedial measures and to provide information services necessary for implementing the management guidelines. With the large area involved, four RC&D projects would probably be formed, covering (1) the Klamath Basin in Oregon, (2) the Northern Basins in California, (3) the Eel and Mad Basins, and (4) the Southern Basins.

RURAL ENVIRONMENTAL ASSISTANCE PROGRAM (REAP)

All of the proposed remedial measures in the recommended land treatment programs for private grassland and timberland are eligible for federal cost-sharing under the REAP. Assuming that REAP payments for practices in each county are spread uniformly over that county, the total REAP funds available to the basins in fiscal year 1969 would have been $500,000 for the portions of the counties involved.

A special REAP project could be formulated to install the land treatment program in the study area, and additional funds would be allotted for this purpose. The maximum amount of money that would probably be available under this type of project is about $300,000 a year for the 20-year installation period. About $1,099,000 a year would be needed.

FARMERS HOME ADMINISTRATION LOAN PROGRAM

FHA could loan money to qualified private landowners to pay their cost-share of installing the remedial measures. In 1969, FHA had about $1 million available for this type of loan for the entire state, but to date, there have been no loans made for grazing improvements in California. The program calls for $831,000 a year of non-federal money for land treatment measures during the 20-year installation.

AGRICULTURAL EXTENSION SERVICE

AES could provide leadership in the educational and informational program to make landowners and the general public aware of the need for the land treatment program and the benefits that can be derived from its installation. Their technical advice on fertilization, seeding, livestock management, and forestry would be valuable assistance in applying the land treatment program.

OTHER ACTIONS NEEDED

The total cost of the recommended program is $159,393,000 and would amount to $7,970,000 annually during the 20-year installation period. The previous chapter "Opportunities for Assistance from U.S. Department of Agriculture" indicates that present legislative authority could allow the federal government to provide up to 74 percent of the amount needed for installation. This does not include the amount of money needed for maintenance of the program on federal land. In order for the program to be installed in a 20-year period, increased funding through present authorities will be required if the federal share of $5,889,000 is to become available annually during the installation period. In addition, new legislation to allow the federal share to exceed present levels may be desirable to get complete installation on privately owned land.

PRESENT LEGISLATION

The recommended program could be accomplished within existing legislation but the amount of funding would have to increase as shown in the following tabulation:

Program Elements	Annual Funding ($1,000) Present	Annual Funding ($1,000) Recommended
Federal Land		
Road Measures	753	3,117
Land Treatment	174	241
Private Land		
Structural Measures	430	1,432
Land Treatment	318	1,099
	1,675	5,889

In order for the program to be accomplished within the existing legislation the following actions would be needed:

1. The program on federal land should be accelerated by increasing the appropriations to the administering agencies by $2,431,000 annually during the installation period. The program on privately owned land should be accelerated by increasing the funds to the agencies involved by $1,783,000 annually during the installation period to cover the added federal cost-share.

2. To coordinate the USDA programs on privately owned lands, the Secretary of Agriculture should designate an individual or agency to provide leadership at the local level. This would accomplish the program in an efficient manner and prevent duplication of effort by the several agencies administering the USDA programs.

3. A local association, such as a range improvement district or an association of resource conservation districts, should be formed to represent the landowners and provide the overall leadership for the land treatment program on private lands. Direct local participation would provide better opportunities for cooperation between federal agencies and landowners and for successful completion of the land treatment program. In any association formed, ranchers should be well represented since their interests are most deeply involved.

NEW LEGISLATION

New USDA programs or legislation would be another way to accomplish more of the land treatment program on privately owned lands. The following ideas might provide a framework for developing a new USDA program. These ideas are not necessarily endorsed by the USDA but are presented as possibilities for the consideration of the concerned public.

1. The federal cost-share for installing the land treatment measures on privately owned grasslands could be increased from the present 50 percent to 90 percent. It should be raised to 100 percent for those measures to be applied on severely eroded grasslands to encourage landowners in the restoration of this land. This proposal would increase the federal cost of installation by $9,412,000 from $117,787,000 to $127,199,000 or from 74% to 80% of the total installation cost of $159,393,000. During the 20-year installation period the annual funding would be increased on private land treatment measures by $471,000 from $1,099,000 to $1,570,000. These increases would provide a greater incentive for landowners and operators to participate. The present federal cost-share for remedial measures on other privately owned lands is probably adequate because the major benefits accrue to the landowner in the form of increased production. Interest-free loans, deferred payment of loans, and safeguards for continued maintenance or retirement should also be considered.

2. Landowners of severely eroded private grasslands should be compensated for excluding livestock from these areas. If they are remunerated for property taxes, more landowners would participate in this portion of the program. Once the treatment programs are installed, the stabilizing effects should not be allowed to degrade by a return of improper use. Adequate maintenance and usage must be assured by long-term agreement.

3. Formulate a regional program to develop and protect large regions, such as the North Coastal Area of California. Problems in flood control, fish and wildlife, recreation, and urban development would be considered in addition to those of agriculture and forestry. A regional agency under state and local

leadership would be established to develop and coordinate the activities of the local people and the cooperating state and federal agencies. This agency and its cooperators would formulate a coordinated plan to develop and protect the resources of the area, making use of private resources and existing state and federal programs. Congress would appropriate the necessary federal money, and the state would contribute funds to cover its share. Each of the cooperating agencies would be assigned responsibility for certain functions of the plan and would be given funds by the regional agency to implement their responsibilities. Prior to starting work, detailed work plans would have to be prepared for each function or phase of work.

4. Form a council of USDA agencies to provide the overall leadership and to coordinate the activities of its agricultural and forestry programs. The council would cooperate with local associations or agencies to establish the policies and goals of the land treatment program on private lands. It would assign the responsibilities for various functions to the appropriate USDA agency and would allocate the necessary funds to carry out these functions.

5. Provide a specifically funded program similar to that for the Great Plains Area that would provide for federal-local sharing of the land treatment program costs on private lands in the North Coastal Area. A local association cooperating with the USDA agency designated to administer the program would establish the policy and goals. A treatment plan with specific time limits would be developed for each property by the owner and the two groups. Prior to starting the work, a contract between the owner, the local association, and the USDA agencies would be signed, assuring that the necessary amount of federal funds would be made available to landowners during the agreement period.

The present USDA programs with increased funds or the legislation of new programs could accomplish most of the land treatment program. Since there are always a few individuals that will not participate, voluntary programs like these cannot be entirely successful, regardless of the incentives provided. To fully accomplish the objectives of the land treatment program, restrictive legislation would be necessary, although this approach may be politically unacceptable. Some possible actions would be to:

1. Enact state or local laws requiring landowners to protect the soil and vegetal resources on their land, with stiff penalties for failure to comply with the laws.

2. Purchase the land or property rights from the present owners, under condemnation proceedings if necessary, and resell or lease them with appropriate controls on their development and use.